PRACTICAL ENGINEER

A monthly journal, devoted to the economical generation and utilization of power and the interests of stationary engineers

VOL. XIII CHICAGO, JULY, 1909. No. 7

SECURITY BANK BLDG. POWER PLANT, SIOUX CITY, IA.

WHILE the very fact of size, prominent always in inspection or description of the large modern central station, creates an impression upon the mind of visitor or reader, on the other hand the ingenuity displayed in developing the full extent of the resources of many relatively small central plants also prompts admiration, and moreover offers valuable suggestions applying to operation and profitable utilization both of product and byproduct which can be considered to excellent advantage by owners of plants of similar size and similarly situated. Such a plant is that of the Security Bank Building at Sioux City, Iowa, of which James A. Coulson is chief engineer.

FIG. I. ENGINE ROOM IN SECURITY BANK BUILDING WITH ENGINEER COULSON AT LEFT

Before proceeding to detail the extent of territory covered, and amount and varied character of service supplied from this relatively small plant, careful note should be taken of those items comprising its mechanical equipment listed. Unless we are greatly in error, capable management, after all, is chiefly responsible for the surprisingly large amount of work developed and the flattering results obtained in the operation of this plant.

The steam units consist of 2 150-hp. Heine boilers, Jones Stoker fired, which furnish steam to 3 12 by 11-in. American Ball engines, each driving, direct connected, a 110-volt, direct-current Triumph generator, one being of 50 kw., a second of 60 kw. and the third of 62.5 kw. capacity. For elevator and fire service there are, one 14 by 20 by 12 by 18-in. Blake duplex compound pump; one 14 by 8.5 by 12-in. Burnham pump; one 18 by 12 by 10-in Worthington fire and elevator pump and 10 small service and house pumps for boiler feed, returns, etc. The freight elevator shaft leads from the boiler room and by the installation of a 48-in. exhaust fan in the shaft at the fourth floor a very efficient system of ventilating both boiler and engine room has been devised. The Security Bank Building is equipped with the Johnson heat regulating system installed by the Johnson Service Co., Milwaukee, and the newly completed Farmers Loan and

Trust Building is equipped with the Van Auken Vacuum system.

In order to assist the reader in forming a better idea of what this plant of 300 boiler horsepower accomplishes in the generation and distribution of light, heat and power, attention is directed to the combination view and the plat which show 4 of the buildings which are supplied with the above named utilities and indicates the relative locations of these buildings and others included in the scheme of distribution. The power plant, as before mentioned, is located in and is a part of the Security Bank Building.

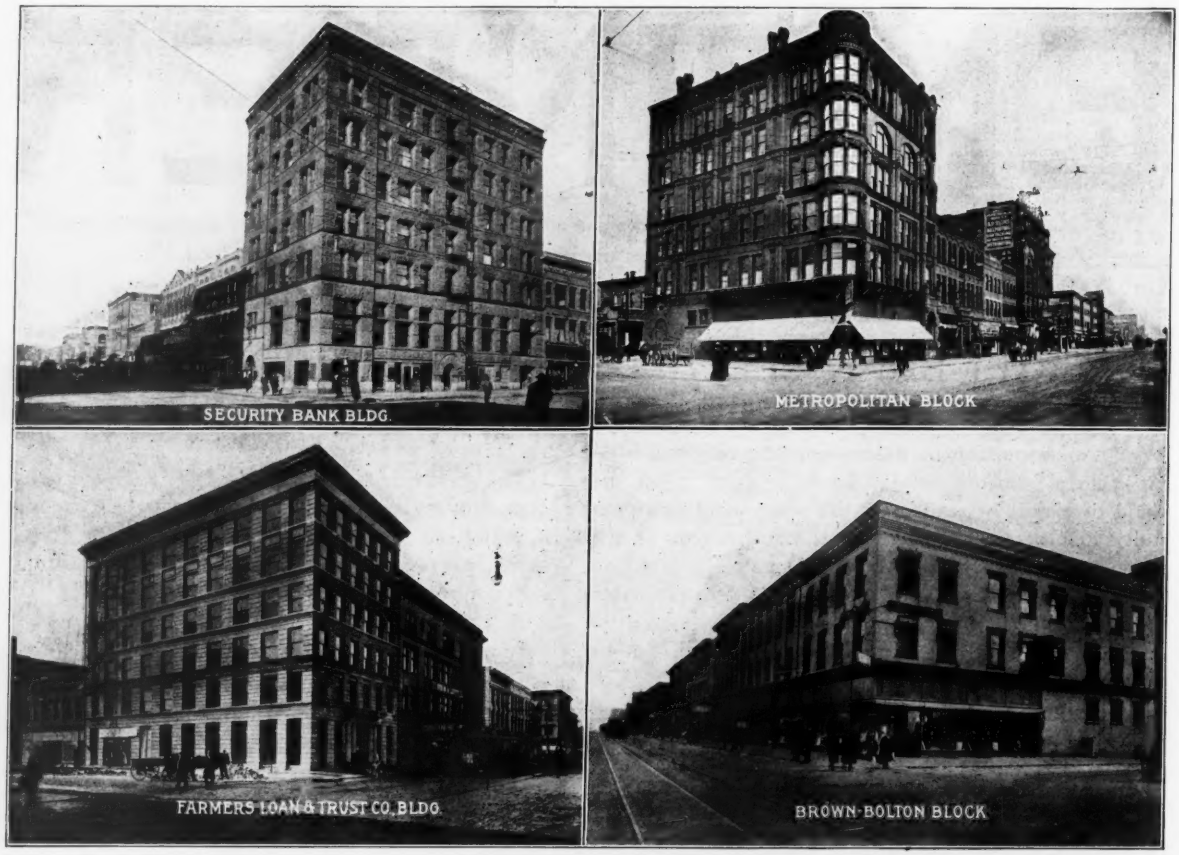


FIG. 2. FOUR OF THE BUILDINGS SUPPLIED FROM THE PLANT

Originally intended to supply the necessary light, heat and power requirements of that building only, judicious operation has enabled a reserve capacity to be utilized in supplying the same essentials to neighboring properties. The number and names of these buildings, their size, the nature of service supplied, and the methods employed in distribution, are facts set forth more clearly perhaps by means of plat and views than could be done in any other manner, although one building—the First Presbyterian Church—to which lighting current is furnished is not shown on the plat because of being just outside of the business district. In addition also is the Hawkeye Electric Co., which takes about 1000 kw. a month in direct current and distributes it to dentists, physicians and moving picture machine operators.

The total current output of this central plant varies according to season, from 15,000,000 to 21,000,000 watt-hours per month and the heating load in season amounts to a little over 25,000 sq. ft. of radiation.

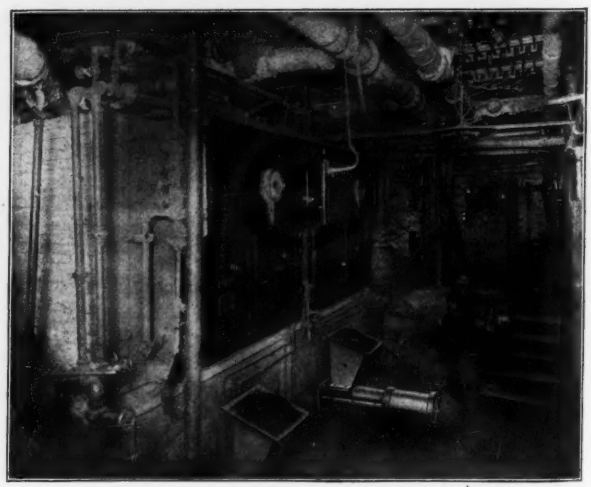


FIG. 4. BOILER ROOM SHOWING HEINE BOILERS AND JONES STOKERS

When taken in connection with the operation of pumps and numerous smaller steam requirements of the Bank Building itself, some estimate may be formed of the duty obtained from this plant. Another feature deserving special mention is the character of fuel used and in order to show this in a readily understandable manner, we give the tabulation denoting character of the fuel used in this plant based upon analyses at

	No. 1	No. 2	No. 3	Average
Vol. Comb.....	26.51	23.96	27.52	26.00
Fixed Carbon.....	41.02	33.42	29.22	34.55
Moisture	10.42	11.74	9.46	10.54
Ash	22.05	30.88	33.80	28.91
	100.00	100.00	100.00	100.00
B. T. U. per lb....	9614	9136	8231	8994

different times of 3 samples of the coal, and to assist in further appreciating its character, reference is made also to the Average column. This class of coal is being used with utmost success in the Jones Under-Feed System and since the apparatus was installed some 2 yr. ago, a considerable economy has been effected in cost of fuel as well as securing the very necessary object of steadiness in steam pressure and general reliability in operation of the boiler plant.

C. K. Williams is manager of both the Security Bank Building and the Metropolitan Block, the latter owned by the Midland Realty Co., of which W. P. Manley, president of the Security Bank Building Co., and one of the prominent financial men of that district also is president.

In view of the splendid returns obtained from the power plant it is justly due to give unstinted credit to J. A. Coulson, chief engineer. As might be inferred, Mr. Coulson is a man most highly skilled in his profession and always has been prominent in engineering affairs. He has been secretary of the Iowa State Association of the N. A. S. E. since the State Association was organized about 5 yr. ago, and also is a member of the Board of Examining Engineers for Sioux City.

A COMPLETE HYDRO-ELECTRIC PLANT is to be installed at Fort Yellowstone, Yellowstone National Park, by the United States Government, including penstock and concrete power house.

This installation will be used for furnishing light and power throughout Yellowstone Park and will consist of 3 150-kw., alternating-current, 3-phase, 60-cycle generators, each direct connected to 1 280-hp. D'Olier Francis

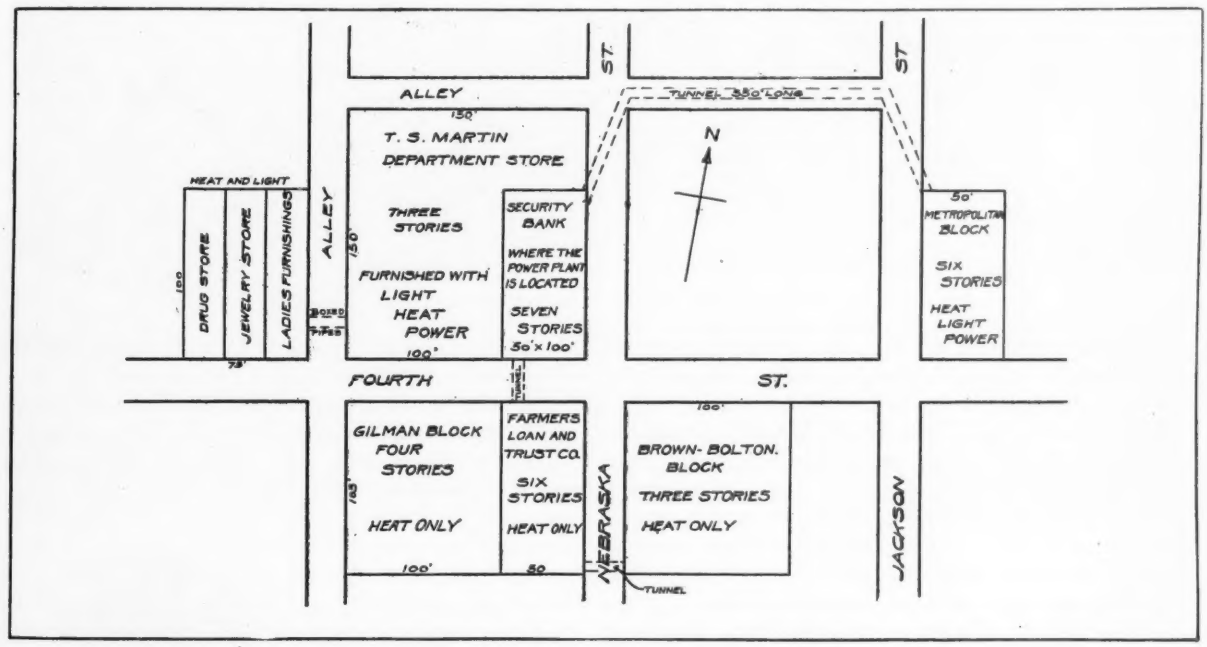


FIG. 3. PLAT OF DISTRIBUTION AREA FOR POWER

turbine water wheel operating under a head of approximately 275 ft.

The water will be carried to the power house by a 26-in. steel penstock, which will be provided with automatic relief valves and large air chamber to aid in the regulation of the turbines, as the matter of regulation presents some difficulties, owing to the length of the penstock, which is approximately 2,200 ft.

The turbine will be of the single discharge type, with 22-in. runners mounted in cast-iron spiral flume on a horizontal shaft and discharging into the cast-iron quarter turn fittings resting on cast-iron base plate. The wheels will be of Government bronze and the swivel gates will be of manganese bronze of the latest swinging type. An effective fly-wheel is provided on each wheel.

The entire installation is of the most modern type, installed by the D'Olier Engineering Co., and it is expected that high efficiency and low maintenance expense will be secured.

TYPES OF TURBINE WHEELS AND INSTALLATIONS

COMPOUNDING; HIGH HEAD; DRAFT TUBE PRACTICE; GOVERNING

BY FRANK KOESTER

AN INTERESTING medium head turbine has recently been installed in Wiesberg, Tyrol, and is the first of its kind ever attempted. It is a compound turbine of the Francis spiral type, the reasons for adopting it being as follows: In the above-mentioned plant there were installed 3 Francis turbines of 1,500 hp. each, operating under a head of 285 ft. and making 300 r. p. m. During operation, much erosion was observed, and the turbines lost their efficiency, due to the increased clearance between the runner and the guides. As these turbines are fed by glacial water, which, in the summer contains much sand, the erosion continued during the winter months when the water is entirely free from sand.

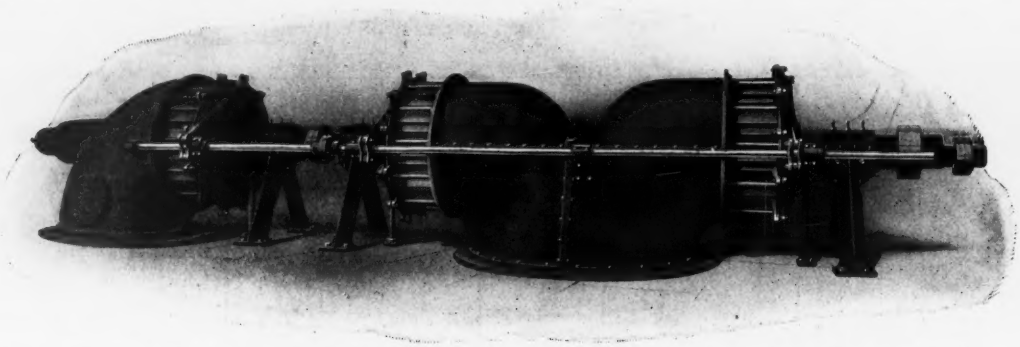


FIG. 1. SET OF SINGLE WICKET GATE WHEELS IN AN OPEN FLUME BUILT BY S. MORGAN SMITH CO.

The unit consists of 2 opposing turbines mounted on the same shaft, interconnected, so that the discharge of one becomes the supply of the other, thus reducing the head of each turbine from 285 to 142.5 ft. The spiral casing of each turbine is of cast iron, and made in 2 parts with an inlet of 33.5 in. diameter. Both runners are of the same size, 41.25 in. diameter, and are of cast steel, having 19 vanes. With a water consumption of 88 cu. ft. a second, the compound turbine develops 2,260 hp., making 342 r. p. m., giving, with gate openings of 30, 60 and 90 per cent, efficiencies of 67, 81 and 86 per cent, respectively.

After the turbine had been a year in operation, it was inspected and no evidence of erosion was found, in fact, much of the original coating of paint on the vanes was still intact.

High Head Type

Probably the highest head developed is that at Vouvry, near Lake Geneva, Switzerland, where a plant has been constructed for a maximum capacity of 20,000 hp. The present equipment consists of 4 500-hp. and 1 2,700-hp. turbines, operating under a head of 3,116 ft.

The favored turbine for high head, on account of simplicity, is the Pelton wheel, which consists of a wheel with a number of buckets, circumferentially mounted. The usual mounting of the wheel is horizontal, but it may be vertical; 1 or 2 wheels are mounted on a single shaft.

Water from the penstock is directed against the buckets through one or more nozzles, which, according to American practice, are of the deflecting type. For changing the speed of the wheel, the nozzles are deflected, or in case of a shutdown, the water is thrown off the buckets and discharged into the tail race.

Nozzles of the European Pelton wheels are rigid, and so designed that when the speed is altered, or the wheel shut down, little or no water is wasted. This is accomplished by providing the nozzle with a by-pass, which opens simultaneously when the nozzle closes, and gradually closes with the shutting down of the main relay valve, all of which is automatically controlled. The whole performance can be regulated to a few seconds.

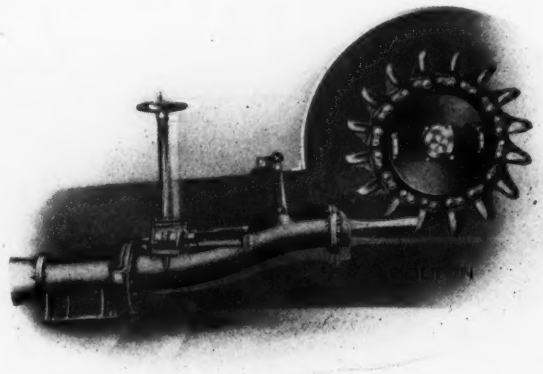


FIG. 2. THE PELTON WHEEL

Draft Tube for Pelton Wheel

As a usual rule, Pelton and other impulse wheels do not have draft tubes; to the writer's knowledge, there is only one plant in which the impulse wheels

are provided with draft tubes, that installation being at Chur, Switzerland, where a number of 250 hp. wheels operate under a head of 272.5 ft. Each wheel has 2 needles. The head gained with the use of draft tubes is about 15 ft.

Wherever an impulse wheel is provided with a draft tube, the wheels run in partial vacuum; the water column in the draft tube must be so regulated that it is always a few feet below the wheel, therefore, near the junction of the upper end of the draft tube and the turbine, must be located an air cock, which may be controlled by the governor or by hand. Such

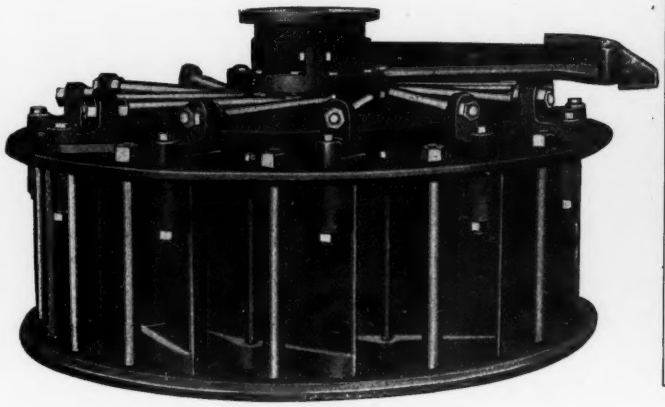


FIG. 3. BALANCED GATE MADE BY THE WELLMAN-SEAVER-MORGAN CO.

draft tube arrangement is preferable for small wheels, and particularly, where owing to ground water or other reasons, they cannot be located near the tail race.

Wherever possible, turbines should be equipped with draft tubes in order to secure additional head, which would otherwise be lost. The theoretical length of a draft tube is equal to perfect vacuum or 34 ft. Owing to losses due to velocity, friction, etc., in the draft tube, which cannot be counteracted, perfect vacuum is never realized. In practice, the height of the water in a draft tube decreases with the increase of the latter's diameter, and vice versa.

From Meissner's "Hydraulische Motoren," the accompanying approximate figures have been converted into English units; the dimensions are given in round numbers.

DRAFT HEAD FOR TURBINE WATER WHEELS

DIAM. OF DRAFT TUBE IN FEET	DRAFT HEAD IN FEET	DIAM OF DRAFT TUBE IN FEET	DRAFT HEAD IN FEET
1	30.0	6	17.0
2	27.0	7	15.5
3	24.0	8	14.0
4	21.5	9	13.0
5	19.0	10	12.0

Draft tubes should always be made conical, so as gradually to reduce the velocity of discharge, and at the upper end must be of the same size as the discharge opening of the turbine casing, to avoid any abrupt change in the velocity of the water. The velocity of discharge from a draft tube should be about 2 ft. for low head, 3 ft. for medium head, and 4 to 7 ft. for high head turbines.

FIG. 4. INTERIOR OF NECAXA PLANT, MEXICO, 5,000 KW. GENERATORS DRIVEN BY IMPULSE WHEELS UNDER A HEAD OF 1,300 FT.

Draft tubes should be straight and as free from turns as possible, this is particularly true of long draft tubes. The end must be water sealed some 6 to 12 in. at low water level for small-sized tubes, and 18 to 24 in. for large ones.

Tubes are made of cast iron, structural steel, or as a part of the concrete foundations. When made of metal they must be strong enough to stand atmospheric pressure (perfect vacuum is equal to a water

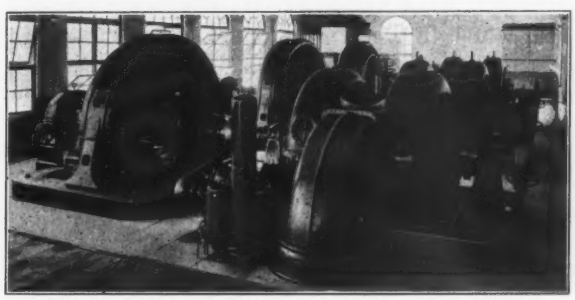


FIG. 5. DOUBLE FRANCIS TURBINES RUNNING GENERATORS IN PORTLAND RAILWAY LIGHT & POWER CO.'S PLANT.

column 34 ft. high or a pressure of 14.7 lb. a sq. in.), and any pulsations which might arise from starting the turbine and running it under great variation of load; for the latter reason, a long draft tube must be properly anchored.

Governing

Turbines and water wheels coupled to generators must be provided with governors of proper design to regulate them so that the speed will be nearly constant. Poor regulation in an hydroelectric plant may have its origin in the hydraulic end, such as water-hammer, surging in the penstock or draft tube, loss of vacuum in draft tube, etc., in the mechanical end, poor operation of the turbine and supply gates, controlling of waste water in case of a sudden shut down, which might arise from the hydraulic, mechanical or electrical end of the station.

There are, of course, other factors which necessitate the choosing of a governor, adaptable to control load fluctuations for the particular plant. For instance, good operation of a high head plant may be accomplished by quick acting or slow acting governors; where the load of a plant is steady, a slow acting governor gives best results, and vice versa.

In addition to a governor, the turbine may be provided with a flywheel; to eliminate this the runner of the turbine, or the revolving field of the generator may be designed to serve the same purpose. As indicated, a plant with great load fluctuations is best regulated by a quick acting governor; but governors of this kind must be provided with auxiliaries to by-pass the water into the tail race, as otherwise the sudden cutoff of a moving column of water will set up violent surges in the penstock, which are liable to damage it or the governor.

As the by-pass water is always wasted, the governor should be designed to cut off the entire supply, soon after the wheel shuts down, as otherwise the operation of the plant is uneconomical.

TODAY'S BURDENS will last only through today. Anyone can live sweetly, patiently, till the sun goes down. And this is all that life ever really means.

DIAGONAL RIVETED JOINTS

By NORMAN S. CAMPBELL

NUMEROUS articles have been written dealing with the efficiencies of riveted joints in steam boiler shells, particularly the longitudinal joints. I shall endeavor in this article to show the methods used to calculate the efficiencies of diagonal joints. The diagonal joint is so called because it makes an acute angle with a line running lengthwise of the boiler or with the girth joints as shown in Fig. 1.

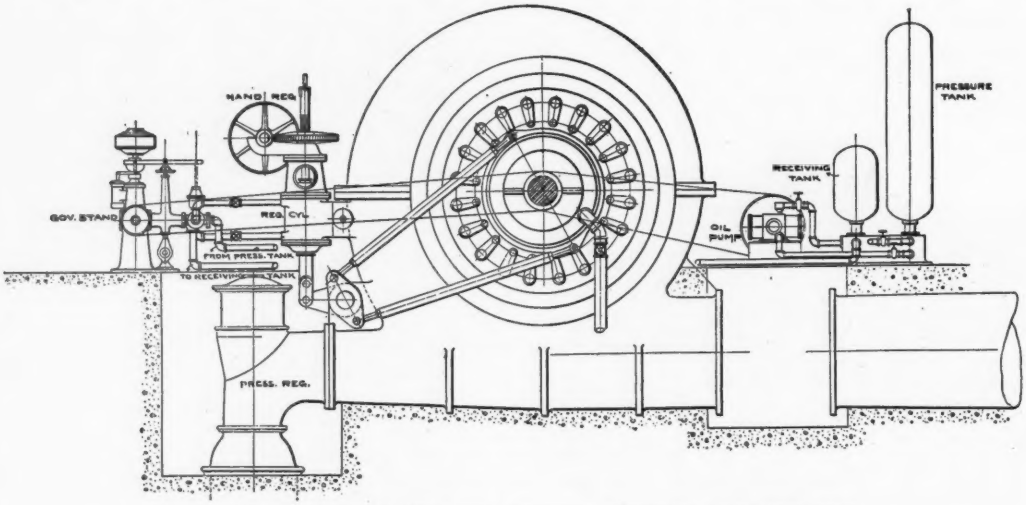


FIG. 6. ALLIS-CHALMERS OIL PRESSURE GOVERNOR ARRANGEMENT

In calculating the strength of riveted joints it is customary to use only a single unit of the joint, the unit being a section of the joint of such length that the joint can be said to be made up of a series of these units. A unit of a joint in length is equal to the pitch of the widest spaced rivets. The advantage of using the unit in calculating the strength of a joint is that we do not have to take into consideration the whole joint because the efficiency of the whole joint is equal to the efficiency of the unit.

It will be seen in Fig. 2 that the units 1, 3, 4 and 5 are each equal to 2, the one under consideration, consequently the efficiency will be the same.

In calculating the strength of diagonal joints the term efficiency is used in 2 different senses. The common definition of the term efficiency is the fraction or percentage that the solid plate must be multiplied by to give the strength of the joint. This we will call the ordinary efficiency.

The other term efficiency may best be explained as follows: We will suppose that a hydrostatic pressure is applied to a boiler until a rupture takes place and, if the material is of uniform strength and thickness, it will rupture along the longitudinal joint. This we will call the bursting pressure with a joint. Now, consider this same shell without a joint and we apply a hydrostatic pressure until it ruptures, which will also take place in a line parallel to the length of the boiler if the

shell is of uniform strength and thickness. This we will call the bursting pressure without a joint.

Dividing the bursting pressure with a joint by the bursting pressure without a joint gives what is called the effective efficiency. In longitudinal joints or joints with the same stress in all directions, these 2 efficiencies are the same; but not so in a diagonal joint, the reason for this being that with a boiler under pressure the strain is greater along the circumferential direction than in the direction of the boiler's length.

To illustrate we will mark off a section of any convenient length, (say 1 ft.), on a line A B Fig. 3 and on equal length on E F, the strain on the part marked off on E F would be only half as great as the strain on the marked part of A B. The joint C D has an efficiency of 72 per cent as compared with the solid plate along E F. It has an efficiency of 144 per cent when compared with the solid plate along A B. Then it follows

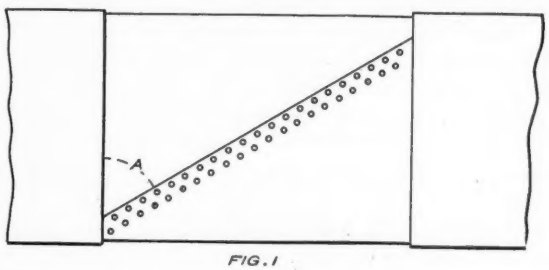


FIG. 1

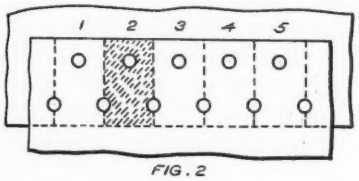


FIG. 2

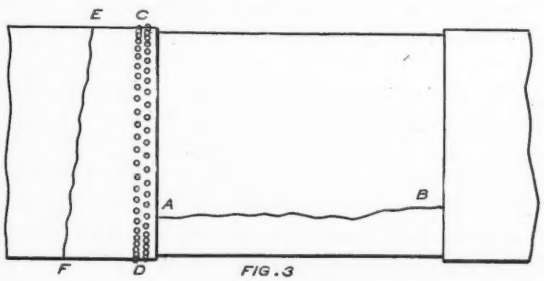


FIG. 3

FIG. 1. DIAGONALLY RIVETED JOINT
FIG. 2. LONGITUDINAL JOINT
FIG. 3. GIRTH JOINT

that C D has an effective strength of $0.72 \times 2 = 1.44$ times as great as a joint of equal length along A B.

Now suppose instead of running lengthwise and girthwise these joints run diagonal as shown in Fig. 1. The effective strength of these joints will then be somewhere between 72 and 144 per cent when compared with a constant unit of solid plate of equal length. It will differ according to the angle that it forms with the girth joint.

To derive a formula we would have to resort to trigonometry, but for practical uses the accompanying table has been given by the Hartford Steam Boiler Insurance Co.

Rule: To find the efficiency of a diagonal joint first find the efficiency in the usual manner as you would for an ordinary longitudinal joint. Then measure the angle A, Fig. 1, that the diagonal joint makes with the girth joint, and find in the table the factor opposite this angle. Multiply the efficiency as found above by the factor; the result will be the effective efficiency of the diagonal joint. The effective efficiency is then used in finding the bursting pressure of a boiler in the usual way.

FACTOR USED IN FORMULA FOR DIAGONAL JOINTS

A	FACTOR	A	FACTOR
30°	1.51	50°	1.20
35°	1.42	55°	1.15
40°	1.34	60°	1.11
45°	1.27	65°	1.08

To illustrate, suppose that it is required to find the safe working pressure of a boiler with diagonal joints which make an angle of 45 deg. with the girth joint. The joint is double riveted, rivet holes being ⅞ in., pitch of rivets 3 in., tensile strength of plate 55,000 lb. a sq. in., thickness of plate ⅜ in., shearing strength of rivets 40,000 lb. a sq. in., diameter of boiler 60 in., using a factor of safety of 5.

To find the bursting pressure of a jointless shell of the above dimensions we multiply the tensile strength by the thickness of the plate and divide by the radius which gives

$55{,}000 \times \frac{3}{8} = 20{,}625$.

$20{,}625 \div 30 = 687$ lb. to a sq. in., which is the bursting pressure of the shell if it were jointless. To find the actual bursting pressure of the boiler we must multiply 687 by the effective efficiency of the diagonal joints. The ordinary efficiency of a longitudinal joint of these dimensions is found to be 72 per cent. Now, opposite 45 deg. in the table we find 1.27.

$0.72 \times 1.27 = 0.91$, which is the effective efficiency of the joint. Multiplying the bursting pressure as already found by this effective efficiency we have,

$687 \times 0.91 = 625$ lb.

$625 \div 5 = 125$ lb., the safe working pressure.

Had the joints in this boiler been longitudinal instead of diagonal, the safe working pressure would have been 99 lb. It will be seen from this that the diagonal joint is much stronger than the longitudinal for reasons already pointed out, the stress in a boiler being greater girthwise than it is lengthwise. The smaller the angle it makes with the girth joint the greater will be its effective efficiency. It would be useless to calculate a joint that made an angle of less than 35 deg. with the girth joint because its effective efficiency would be over 100 per cent, which is stronger than the solid plate.

GAS ENGINES AND PRODUCERS

POINTS FOR THE GAS ENGINE PLANT

IGNITION CIRCUIT; PACKING; BEARINGS

By John Meyerott

THE engineer who thinks he has had a nerve-racking job operating a steam engine, must not think that the gas engine is the machine for him. If he does, and tries one, he will soon change his mind, unless he is well posted in many of the scientific branches and is able to reason for himself.

I heard a story of 2 men talking about gas and steam engines, 1 man had had experience with both gas and steam engines and the other had not. This man wished to know the difference between the 2 engines and asked the question: "What is the difference between the gas and the steam engine?" The answer he got was this: "So far as operation is concerned, there is not much difference, but if something happened to go wrong, the difference is this, with the gas engine it requires 2 to 3 hr. to find the trouble and 1 minute to fix it. With the steam engine it requires 1 minute to find the trouble and 2 to 3 hr. to fix it." Now this is true unless you have had considerable experience, or are well posted in the theory of the gas engine and its operation.

To many engineers, the gas engine is simple so far as they can see, but the fact is, you cannot see so very far until you try to run it with the same idea in view as for a steam engine. In economy, the gas engine should at least double that of the steam engine, and in operation it should be equal.

If you wish to accomplish this, you must understand how to make changes in valve setting, timing of ignition and fuel supply. Then if something fails to work properly and thus causes a shut down, you must be able to tell from the action of the engine what the trouble is and how to remedy it.

If your engine begins to miss fire at intervals, you will find that this will be caused by a loose connection in the ignition system, weak battery, sluggish movement of movable electrode in a make-and-break system or corroded joints on the vibrator of the jump spark system, weak mixture or sluggish closing movement of the exhaust valve.

The first thing is to examine the wire connections on the electrodes, also the movable electrode, or the vibrator adjusting screw on the vibrator coil and the commutator if a jump spark is used. If these are all tight and in good order, examine your exhaust valve and if possible put some kerosene on the stem with a squirt oiler. Then slightly increase the fuel supply. If you fail to locate the trouble by this means, you may be sure that your battery is weak and needs new cells or recharging.

If your engine fails suddenly, you will find the ignition wiring broken, movable electrode stuck, vibrator contacts welded, commutator out of working order, inlet valve or exhaust valve not seating. The last 3 causes can be detected by the failure of the engine to compress the charge on the compression stroke.

Failure in economy may result from leaky exhaust valve or piston rings, improper timing of inlet or exhaust valve, improper timing of ignition, too much cylinder oil causing clogging of exhaust pipe, not enough cylinder lubrication, causing friction, wear and leakage, or too much fuel, causing soot and direct waste.

Occasionally a gasket will blow out and thereby cause trouble by water getting into the cylinder. This I have found to be a source of trouble uncalled for. As a general rule the gasket that is put on at the factory will not blow out, but the first time the engine gives trouble, the man in charge concludes that there is something wrong inside and the cylinder head is removed. Ninety-nine times out of one hundred he fails to find anything wrong inside and he replaces the head with a new gasket, and perhaps will break it at some point, or fails to remove thoroughly the old one, and either one of these will cause trouble by blowing out.

My advice is, never remove the cylinder head, unless absolutely necessary. If you wish to see the inside or wish to remove some object from the inside, withdraw the piston. If you wish to regrind a valve located in the head, do it with the head on if possible. But if you must remove it, be sure that every particle of the old gasket is removed before replacing a new one and the head. The new one should be of the thinnest common asbestos sheet, being very careful not to break it at any point and put it on dry. Do not use water, oil or graphite. Put it on to stay on; tighten all bolts evenly as tight as possible and then fill the jacket with water.

This may not be according to the ideas of many, but I have seen others try wet gaskets, which would fall to pieces before they could get the head in place; others used graphite and invariably had it on thicker in places, causing unevenness of bearing and a nice smooth surface for it to blow out.

I remember 1 job I was called out on. My orders

were to "take the wire filled asbestos as no other will stand." I took some, but I also took the common thin sheet. When I arrived on the scene, the air was rather blue, as the man had been, and was yet using sulphurous language and had used about 2 sq. yd. of asbestos packing and about a pound of graphite. I dared not say much to him, but unpacked my tools and got my scraper and began to scrape the end of the cylinder, he at once flew into a rage and declared I was simply wasting time that he had to pay 75 cts. an hour for, etc. Finally I said to him, I came here to do this work right and intend to do it right, if you will let me; if not, I go back to the shop and leave it undone. That quieted him and I went back to work. I scraped the graphite off until I struck iron in one spot and then I told him to look how much he lacked in getting everything clean. He set to work on the head and finally we had it thoroughly clean; then I cut my gasket, using a light hammer wherever possible, and he brought out his graphite dope, but I refused to use it. He wanted to bet me that it would not stay tight 5 min. and I bet him the cigars it would stay 5 yr. He paid the bet with 5 cigars before I left and also paid his bill, but I used only common thin dry sheet asbestos.

Remember always to scrape until you are scraping on the iron, try the surface with a sharp point, if it is iron you will scarcely make a mark, but if it is graphite, it will leave a deep scratch.

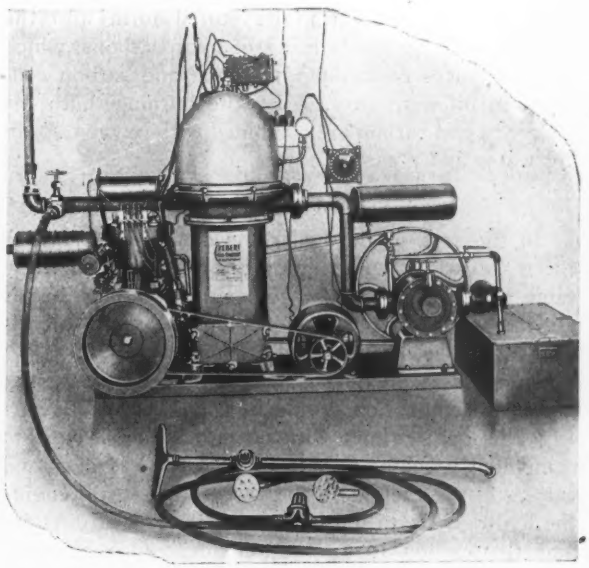
Other points to consider are the temperature of the air and fuel, weather conditions, also altitude. Some engines seem to be more sensitive to these conditions than others and those that are so, are in my estimation, the most economical.

Nearly all the standard make engines have bronze bearings, especially the crank bearing. Now I wish to caution you in regard to the care of this bearing lest it cause you much delay, worry and trouble. Bronze is an ideal metal for such a bearing, but it must be handled with care at all times. In the first place, see that it is a good running fit, if not, scrape until it has an even bearing at points of greatest pressure, being careful that it does not touch at the points of least pressure or joints. Then see that it is well lubricated at all times.

Should it heat from some cause, never apply cold water under any circumstances; if you do, you will ruin the bronze bearing and with it, ruin the pin. If it gets hot enough to cause oil to smoke, shut the engine down and let it cool off until you can handle it with your hands. If you use water, you will draw the temper of the bronze, making it soft, causing it to flake, which in turn will again heat and harden and bury itself in the steel pin. I have seen about 10 sets of bronze bearings ruined thus, costing from $10 to $45 a set, but instead of replacing with new ones, I bored a dovetailed recess in the bronze bearing and filled this with good antifriction or babbit metal, and always had success.

A COMPACT LIGHTING OUTFIT

GAS engines for isolated lighting plants are now commonly used and one of the most convenient and compact units for this purpose is made by the Trebert Gas Engine Co., of Rochester, N. Y. The electric generating outfits are made in sizes from 2 to 60 hp., the gas engine and generator being mounted on the same base and the generator being gear driven. This outfit is especially suitable for lighting churches, halls, stores, factories, hotels and hospitals, and for this purpose is provided, when so desired, complete with switchboard, vacuum pump for vacuum cleaning, storage batteries, dust collector, water tank and the tools for vacuum cleaning.



THE TREBERT GEAR-CONNECTED LIGHTING OUTFIT

For use in structural iron work, for stone cutting and pneumatic air tools of all kinds an outfit consisting of a gas engine gear-connected to an air compressor is also furnished by the same company.

In the Trebert engine the air for the mixing valve is drawn through the lower section or base and sets up a circulation of air around the bearings and lower part of the motor which gives additional assurance of cool running. In a gasoline engine, this air also passes by the gasoline valve and insures that any overflow of gasoline from the mixing valve will be drawn back with the air supply, avoiding loss.

THAT THE RETURN OF BUSINESS ACTIVITY is not confined to a few of the leading lines of industry, but covers practically all branches of production, may be seen in a list selected from orders recently taken by Allis-Chalmers Co. for power generating units of the several types built in its West Allis, Milwaukee, works. The principal facts to be noted are the variety of industries represented and the need, evidently felt by each manufacturer, of providing greater power facilities to meet the now increasing demand for his products.

HEAT CONVERSION IN THE GAS ENGINE

IN ANY form of heat engine the object is to change heat energy into mechanical energy. In the case of the steam engine we use heat by means of a boiler and piping to change a liquid into gaseous form and thus get an expanding fluid behind the piston in the engine. Both boiler and engine are needed for the purpose. In the case of the gas engine the heat is used directly in the cylinder to produce the same effect.

After being heated, the gas or vapor is capable in expanding of converting part of its heat energy into mechanical energy, the reverse of this process being used on the air compressor or ammonia compressor such as is common in ice and refrigerating plants. Heat is transferred from its stored form into the working fluid by the burning of hydrocarbons, which are substances containing hydrogen and carbon conbined in different forms. By the burning, both the hydrogen and carbon are combined with oxygen, forming water and a carbonic gas.

Process of Combustion

In the case of the boiler the combustion may be either to carbon monoxide or carbon dioxide, and the same may be true in the gas engine cylinder, but is not likely because of the mixture of the fuel, which is always in gaseous form, and the air.

In the Gas Review R. B. White, discussing the matter of combustion, speaks of this point as follows:

"This gas we mix with enough air or oxygen to completely combine chemically with the hydrogen and carbon in the fuel, as in the case of the steam engine the hydrogen is to burn to water (hydrogen dioxide) and the carbon to carbon dioxide. This chemical change will set free energy in the form of heat which the gas engine is to transform into mechanical energy.

"How does it perform this operation? This tends to create a vacuum behind the piston—air rushes in behind the piston due to weight of the atmosphere and fills this space. To get into the cylinder the air must pass through the carburetor. As it passes through, gaseous fuel in the form of hydrocarbons (gas, gasoline, alcohol) is mixed with it in proper proportions to give complete combustion when ignited. No matter what kind of fuel is used it must be converted to gas before the ignition. The carburetor's function is to gasify the liquid fuel, such as gasoline and alcohol, and regulate the proportions of fuel (hydrogen and carbon) to the oxygen (air).

"Air is composed principally of oxygen and nitrogen mixed in the proportion of 23 per cent oxygen to 76 per cent of nitrogen. It also contains traces of ammonia, carbon dioxide, argon and vegetaceous matter (germs). The last 4 ingredients, about 1 per cent, are negligible for the purposes of this article. We therefore say the air is about ¼ oxygen and ¾ nitrogen in a free or uncombined state. The nitrogen does not combine with the hydrogen or carbon of the fuel; it goes off in the gases uncombined the same as it went in. It does no good, in fact, if it were absent we would get more power. Nitrogen simply dilutes the oxygen and gives us less of it in a cylinder full than we would otherwise have."

Best Conditions

In order to get the best effect from the combustion we must have the charge in the cylinder compressed, the reason for this being that it gives a higher pressure after combination and, therefore, leaves the hot gas in better condition to do work. This is accomplished in the case of the gas engine by drawing in a charge of gas and air at low pressure and compressing it in the cylinder on the return stroke; in the case of the 4-stroke cycle engine, or in the case of the 2-stroke cycle by the use of a separate compressor pump which delivers the charge to the engine cylinder at moderate pressure, the incoming charge driving out the burned gases.

During the expansion of the heated gases the heat energy is changed into mechanical energy the same as in the steam engine, from 25 to 40 per cent of the heat energy being so transformed. The rest of the heat energy is carried away by the cooling water in the cylinder jacket and with the exhaust gases. The temperature in the cylinder after combustion is in the neighborhood of 2100 deg. F., so that conduction of heat from this charge through the cylinder walls to the cooling water is very rapid. It is desirable to have the temperature in the cylinder remain as high as possible without injury to the cylinder and piston, hence the amount of cooling water used should be as small as possible. If more is used than is needed it means that too much heat is carried away in the cooling water and there is, therefore, waste.

The amount of power that an engine can develop depends on the weight of gas burned in the cylinder. Three causes may reduce the amount burned. In the case of an engine running at high altitude where the atmospheric pressure is low, the air and gas entering the cylinder will be expanded so that a cylinder full of the right mixture of air and gas will weigh less than at sea level, hence there will be a smaller weight burned. If in the mixture there is too much of the fuel, it will permit too small an amount of air to give complete burning, while if the amount of fuel be too small, the extra space will be occupied by air, and again the maximum weight of fuel possible will not be burned in the cylinder at each working stroke.

To get the very best results there must be, therefore, a mixture in such right proportions that the entire weight of fuel taken into the cylinder will be burned, and there will be no excess of air to carry away heat from the cylinder, to take up room which ought to be occupied by the fuel gas and to produce no power effect. Excess of fuel is usually indicated by black smoke in the exhaust. Exhaust of air will only be indicated by a slowing down of the engine if it be overloaded, but either condition will reduce the efficiency of the engine.

IGNITER CIRCUITS

THE best method for causing ignition of the charge in a gas engine is by all means the electrical, which has superseded all other forms. The 2 chief types are the high tension jump spark and the low tension make and break. Energy for either type may come from batteries or dynamos, or may be taken from ordinary electric circuits by interposing resistance.

In the high tension system a spark plug and coil are used to give the high voltage current, and current may be furnished to the low voltage side of the coil either from battery or a direct-current dynamo or a magneto which gives alternating current. When the make and break system is used, direct-current must always be furnished, either from a battery or from a direct-current dynamo. Alternating current is not suitable.

The jump spark system has stationary points inside the cylinder between which a stream of sparks is established by the action of the vibrator, while the make and break has 2 points, one fixed and one movable, the points being brought together to establish current and snapped apart to give each spark.

The method of connecting up where dry cell batteries are used, to get best results, was discussed in the March issue. Wet batteries may also be used but the ordinary type is not suitable except where the engine is stationary and where the batteries can be kept in a comparatively cool place, as if they are kept in a hot room the liquid evaporates rapidly. Where they can be used they are likely to be more durable than the dry cell.

Storage batteries are used to a slight extent in automobile work but are seldom used for stationary work, as it is easier where charging current is available from a lighting circuit or other source to arrange some device for taking current for the ignition circuit direct from the lighting mains.

In choosing the spark coil it is better to have one with a short core of comparatively large diameter, as this gives a greater spark for a given amount of copper winding. The object of the coil is simply to add to the strength of spark when the circuit is broken. The make and break device should be so arranged as to give contact just long enough to get the iron core well magnetized, and then the break should be quick and wide so as to give a single vigorous spark, as this makes it possible to time the ignition accurately and to make the ignition of the charge certain.

The sparking points for either make and break or jump spark are usually of platinum which is less corroded by the spark than any other metal. The points in the jump spark system are mounted in a porcelain plug or, if put into an iron plug, are insulated by mica bushings. The only attention required is to be sure that the insulation is sound and that the points are clean. In the case of the make and break system the fixed point is usually insulated by mica bushings or washers, and the movable point is connected to the frame of the engine, which forms part of the electric circuit and is, therefore, not insulated. Both points should be so arranged that they can readily be inspected and cleaned.

Frequently the break of the circuit which causes the spark is made by a spring on account of the quicker action thus obtained, also the pressure of the 2 points together just before the break is caused by a weaker spring in order to avoid mashing the tips of the igniter points by excessive pressure. In the make and break system, a wiping contact would have certain advantages, as it would be kept clean by the wiping action, but this involves a longer time of contact than is essential from the electrical standpoint and long contact means the use of a larger amount of energy in the igniting circuit and the more rapid running down of batteries where batteries are used.

Gas engines of the largest sizes are arranged with magnetically operated make and break devices, the magnet being arranged to pull the break points apart instead of a spring. The time of this break can, of course, be accurately adjusted by changing the contact in the magnet circuits. The ignition points are usually provided in duplicate for this class of igniters, so that if one set of points fails to work the other one will.

Dirty igniter points and poor contacts in the electric circuit are the most common causes of trouble. The remedy for the first condition is obvious—keep the points clean. The remedy for the second is to go over the wiring regularly to see that all contacts are tightened up and that there is no break in the wires, either at the points of contact or inside the insulation.

EMERY FOR CLEANING IGNITION POINTS

While emery is a convenient method of cleaning ignition points, it has disadvantages, first, because emery is a good conductor of electricity and is liable to cause leakage from the points onto the spark plug, or if emery dust is left between the points it is liable to cause a short circuit; second, because emery, if it is allowed to get into the cylinder, will cut the cylinder walls and piston and do a great amount of damage. Fine sandpaper will answer practically the same purpose, and is free from these objections. It is liable to cut the cylinder walls somewhat but not to the extent that will be the case when emery is used.

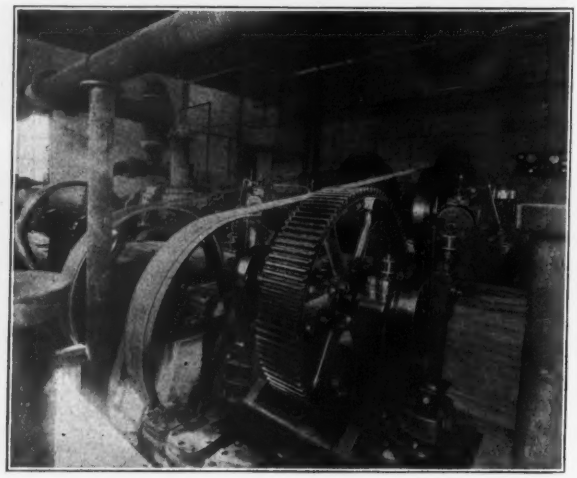
Cleaning of points should be done carefully in any case, as the platinum is rather more expensive than gold and too much filing or rubbing means simply wearing down the points unnecessarily. The method recommended by a correspondent in *Gas Review* when the spark plug is dirty is to take it out, put it in a vise and surround it with gasoline; let it stand a few minutes and then scrub it with a toothbrush. If the plug is very bad, use a decarbonizer before using the gasoline.

OPERATION OF A PRODUCER GAS PUMPING STATION*

BY JAMES R. FITZPATRICK, C. E.

THE Grand Rapids Hydraulic Co. has had experience with gas producers and gas engines since November 1, 1906. The plant was installed at various times during the preceding 6 months, so that on that date it consisted of 2 complete units, each unit comprising a producer, an engine and a double stage centrifugal pump, belt driven from a gas engine.

The first plant consisted of 2 70-hp. suction gas producers, 2 60-hp. engines, and 2 double-stage centrifugal pumps. The engines were 15¾ by 28 in., with a maximum horsepower of about 70, when running at



ENGINE ROOM OF GRAND RAPIDS HYDRAULIC CO.'S PUMPING STATION

190 r. p. m. The producers had 26-in. circular grates. The pumps were 6-in. discharge, and were rated at one million gallons per day of 24 hr. against 200-ft. head.

It soon became apparent that the Hydraulic Co. was in possession of producers that were too small for engines, that were too small for pumps, that were too small for its business. With this unhappy combination naturally we experienced considerable trouble.

In remedying our trouble we first started at the producers, adding a large producer with a 46-in. circular grate in April, 1907. Finally it was deemed best to replace the original plant in its entirety with a larger plant. The contract was let during 1908, and called for 1 additional producer of 46-in. circular grate, 2 100-hp. engines, and 2 triple-stage centrifugal pumps. In December, 1908, it was decided to change the type of pumps, and instead of buying centrifugal pumps, the contract was let for 2 triplex pumps. All of the new machinery was finally installed during March, 1909. Full value of the old plant was allowed by the Minneapolis Steel & Machinery Co., the contractors, when the new plant was purchased.

*Extract from paper read at the American Water Works Convention, Milwaukee, Wis.

It is my endeavor to furnish as near as possible, a practical paper rather than scientific, and for that reason the manner in which we operate our plant will be given.

We use anthracite pea coal, Pennsylvania coal, known on the market as Cross Creek, which is purchased through local dealers. This coal, though comparatively clean and free of slate, is screened again before being used in the producer. We feed the producer every second hour, but poke the producer but once every 24 to 48 hr., opening the grate doors to do this. We run the plant continuously 24 hr. per day and Sunday, using 1 unit. Whenever necessary, in order to maintain the pressure, the second engine and pump are put in operation. We can operate both engines off either producer for a short time, although we find it more satisfactory to have both producers in commission when running both engines. The plant is arranged so that either producer can operate either or both engines through either or both scrubbers.

In starting the engine we always aim to have 140 lb. pressure in the air tank, and a hot spark plug. The first impulse we give with air, and at the proper cycle we generally give a second shot of air, simply as a precaution. We find we can start invariably the first time by doing this. In starting we always leave the ash bed doors of the producer open. This is done so as to prevent a blow-back which would follow in case the inlet valve is held open by a piece of carbon. The cylinder is oiled by means of a pump, while all other bearings are properly oiled, either by cups or running through oil wells.

Once the engine is in operation the operator has to take the usual precautions of examining all oil cups, bearings and cooling devices. We have the engine so arranged that it can be speeded up or lowered while in operation, this being done by means of a heavy spring of considerable tension, which is used to throttle or open up the governor valve.

No friction clutch is used on the pumps. Each pump is equipped on the discharge side with an air chamber, a 10-in. check valve and a 10-in. gate valve. The discharge and suctions are connected up by 2 6-in. by-pass lines, on which are located a 6-in. discharge screw and yoke, by-pass valve and a 6-in. relief valve. The 6-in. relief valve works automatically, blowing off when the pressure is 95 lb. There is a vacuum chamber on the suction side. The by-pass is used in place of a friction clutch in starting up the pump. When an engine is started the force main pressure is withheld from the pump by the check valve. Before starting the 6-in. relief valve is opened wide and the suction line is primed through a 2-in. line, there being a 12-in. foot valve on each suction line. As soon as the engine is up to speed the pump raises the pressure, the check valve opens, and at this time the operator closes the 6-in. by-pass valve. It takes about 5 min. for the engine to get up to its proper speed, and the pump to begin pumping water.

Past Experience

A great source of trouble is inability to get the proper men as operators. We have had all told, in various capacities in our plant, for the past 2.5 yr. over 24 different men on the pay roll. It has been a case of "hire and fire" until we managed to get the present force together, all of whom have been with us, with 1 exception, more than a year.

We found usually that a man who had any knowledge of an automobile or a gasoline engine would represent himself as a gas engine operator, and in nearly all cases demanded wages far above that paid steam men for the same class of work. We had men with 6 weeks' experience operating gas engines, demanding $90 per month, and getting it, for a short time, as for a while we were completely at the mercy of this class of labor. The labor condition has improved considerably, so that now it is not as hard a proposition to get experienced men.

Salvage is an absolute necessity in order to fulfill guarantees, where the producer operating is small. When we had the 26-in. producers, we poked these producers every hour, and had to open the doors and clean the grates. There was in consequence a large loss of good coal fire, which after cooling we screened and put back in the producer. In the large producer we now have, we poke so seldom that there is little or no coal salvage, as all of the product removed from the producer is in the form of ash, excepting when a fire is pulled when we get considerable good coal.

Poke Holes

When the present large producers were first installed they were equipped with poke holes at various elevations around the circumference, and they also had 4 poke holes at a level with the grate, our past experience having taught us that it was easier to clean fire at short intervals, through small poke holes than it was to open the large doors. As things now are, we do not use these poke holes at all, except occasionally to examine the interior of the producer, to see at what point our fire is. Each producer is equipped with poke holes at the top through which we had intended cleaning the sides of the interior brick work in the producer. Our experience has taught us that it is well if your producer is of sufficient capacity to leave the producer absolutely alone, excepting to add coal when needed, and to poke the fire as little as possible. The top poke holes are used now only when cleaning a cold producer.

Vaporizers

Our No. 8 producer is provided with a steel water pan on top instead of a separate vaporizer. We have not had an opportunity to test the 2 vaporizers, to show which is superior, as the No. 7 producer has a separate vaporizer. The steel vaporizer on No. 8 has given excellent satisfaction, and furnishes steam in sufficient quantities to make good gas. In the vaporizer of No. 7, which is modeled like a water-tube boiler, we have had to replace the tubes once in 18 months, as they had been eaten away by the gas. The reason given by the manufacturers for abandoning the separate vaporizers was that they steam slower. The separate vaporizer seems to be in need of repair oftener than the steel vaporizer.

Dry Scrubbers

We abandoned the dry scrubbers as we felt their presence caused the engines to work harder. By screening the coal in advance we were satisfied that the dry scrubbers' use was nullified. We also thought that the dry scrubber, unless absolutely air tight, would interfere with the operation of the engine, and was the one dangerous point in the system, where there was a possibility of an explosion. By doing away with the dry scrubber, the operator is able to use more air in his mixture of gas and air at the engine.

Cylinder Heads

Our cylinder heads are water cooled, but it is permissible to run them warm without any danger. The water that we use is not a soft water, and for that reason we allow it to run more freely so as to do away with the possibility of plugging a valve.

When the small producers were in operation, our piping was not what we wanted, inasmuch as we contemplated a larger producer later, so on a number of occasions we had explosions, due to the fact that there would be fire in the small producers at the time we were blowing up the large producer. The gas being blown over from the large producer through leaking valves in the small producer eventually meant trouble; this has since been obviated in the new plant. All valves should be tested twice each month.

The grates in small producers have a tendency to burn out quickly. We found it necessary to renew the grates in both small producers twice. We have not found this condition in the large producers, one of which has been in operation more or less since 1907.

Repairs

In a general way we found the repairs on the producer to be slight; barring the possibility of grate renewals and renewal of fire door liners, there is little or nothing to be provided for. In the event that the operator allows his fire to get too near the top some trouble may be experienced. The top might possibly crack, or rivets might be burned sufficiently to permit of air leaks at the top of the producer. Under these conditions it is impossible to get gas of the proper quality.

It is always well to have on hand one of each of the following: Spark plugs, trip rods, magnetos, a quantity of mica washers to be for insulation in the spark plug, extra springs necessary in connecting up the ignition mechanism. An extra crank pin box is also a convenience. An extra valve for the gas cock should be kept on hand as occasionally the valve will set, and in trying to open it, it is possible that the

handle would be broken off. This happened on 1 occasion with us.

Reliability

Since the new plant was put in operation, March 29, 1909, we have had 2 shutdowns. In the first case the producer failed suddenly. This was due no doubt to the inexperience. The producer had been running for more than a week. The second shutdown was due to the short circuiting of a spark plug. The operator noticed that 1 engine showed considerable pounding in the crank shaft, and deciding to take it up immediately, put his second engine in operation, after which he shut down the first, and took the crank-shaft box off, for the purpose of making the proper adjustment. While this engine was dismantled, the second engine that he put on began to give trouble. The trouble was a new one to the operator, and before he discovered just what the source of the annoyance was, the engine "died." Later he discovered the source of the trouble. Since May 6 we have had no shutdown of any kind, and the plant has been giving excellent satisfaction.

Having had experience with 3 types and sizes of producers, we are convinced that surplus producer capacity is an advantage and a good fault. The producer capacity should be at least 50 to 75 per cent beyond your needs, in which case there should be little trouble in operation.

We have already made plans to install a 5 ft. by 36 in. air tank, and a 3 by 4 in. double air compressor. We have an extra blower and an extra gasoline engine, so that we have 2 complete starting devices. Our main bearings are extended so that we can attach wood split pulleys, and we contemplate installing counter shafting, so that the compressor and blower can be operated direct by the engine power instead of by gasoline engine. We also intend installing a coal hoist, which will enable us to coal each producer automatically. We have a small machine shop in connection with the plant, the power now being furnished by a gasoline engine. The power for this we will also take from our engine drive.

Conditions

The Hydraulic Co. has a spring water supply collected by a gallery system and carried to a central suction well through 2,500 ft. of 20-in. tile line with open joints. This tile line runs through gravel and clay, the joints, of course, being closed where the line passes through the clay. The suction well is brick, built on an iron shoe, and is 20 ft. in diameter and 20 ft. deep. The well is 125 ft. from the pumping station.

There are 3 12-in. suction lines and 1 8-in. line running to the pumping station. The 8-in. line is not now in commission, having been used formerly with one of the centrifugal pumps. Two of the triplex pumps are connected each to a 12-in. line, and a Blake compound steam pump of 1.5 million gallons capacity is connected to the other 12-in. line. We also have a 2,000,000-gal. Deane, compound, condensing, steam pump, which can be used, and this gets its supply from one of the 12-in. suctions that is connected to one of the Deane triplex pumps. The pumps discharge into the 12-in. force main direct into the system. There is a standpipe located 3 miles from the plant, which is used as a storage for any surplus. The average pressure is 90 lb., excepting during the summer months, when it is 95 to 100 lb.

GAS POWER FOR INTERURBAN RAILWAY SERVICE

FOR many years, internal combustion engines as prime movers were not considered adaptable to electric railway service, owing to the rapid variation of load. Recently, however, gas engines have been improved to the point where they will operate with excellent regulation and are thus able to take care of a load that varies rapidly from no load to full load without any serious change in the voltage of the generators.

One of the latest installations of this class is in the power house of the Kansas and Missouri Interurban Railroad Co. at Overland Park, Kan. The service placed upon these engines is extremely severe, as the track, which is 20 mi. in length, has many curves and steep grades. The track runs from Kansas City, Mo., to Olathe, Kan., with the power house located 8 mi. from Kansas City, delivering power in both directions, directly to the trolley wire without feeders.

There are at present 6 modern interurban electric cars in service, each equipped with 4 General Electric motors of 40 hp. rating, giving a schedule speed of 20 mi. per hour, which considering the character of the road, is extremely high.

The prime movers in the power house of this company are 3 Buckeye gas engines each rated at 336 hp. and running at 175 r. p. m. They are of the double-acting tandem type, with cylinders 18 by 24 in. The engines and generators are mounted upon foundations of heavy concrete, which are sufficiently large to do away with all vibration.

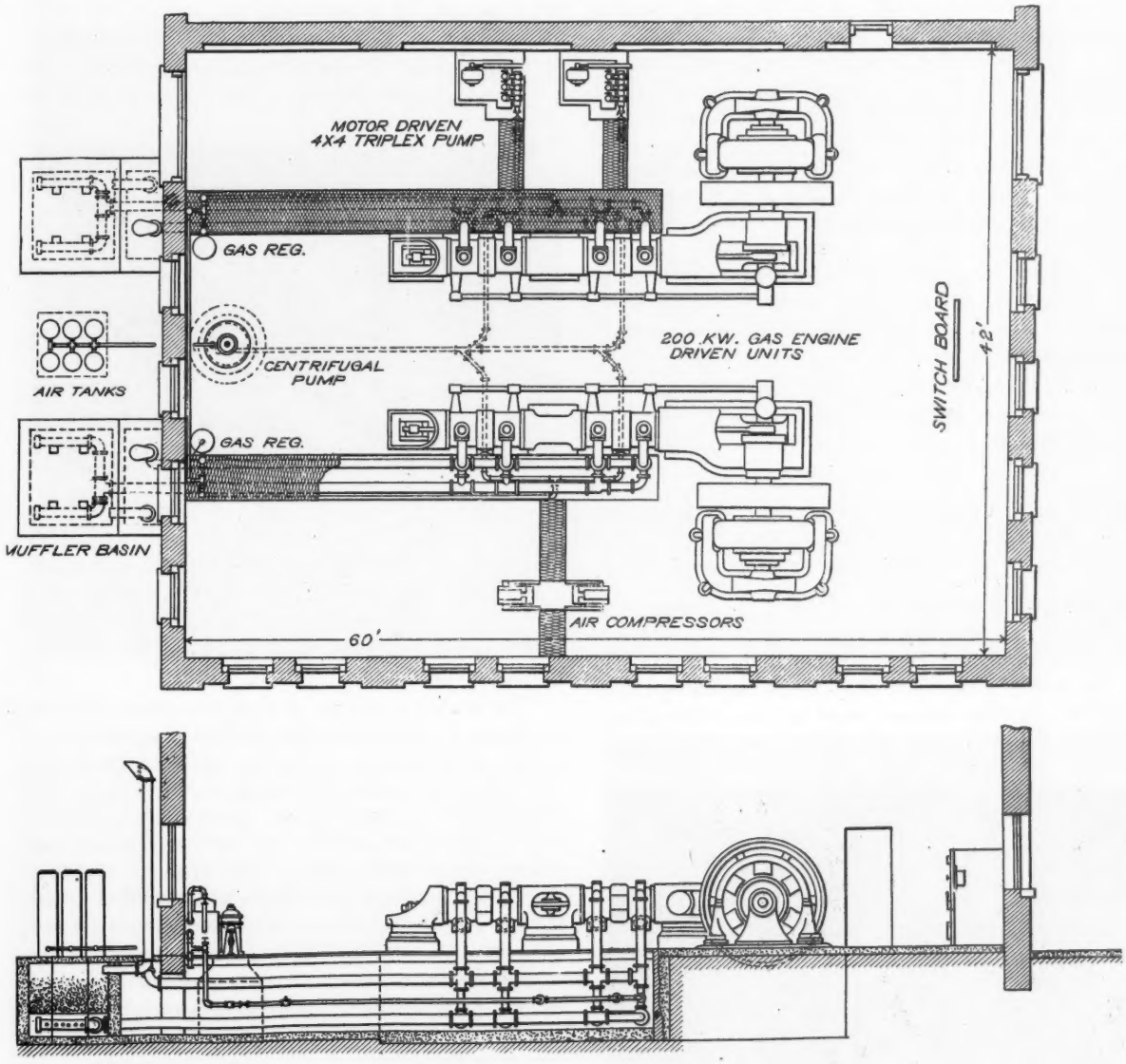
Natural gas is furnished to the engines from wells owned by the railway company, which are supplemented by gas from the Kansas Natural Gas Co. The heat value of this gas ranges from 980 to 1,050 B. t. u. per cu. ft., which are the values upon which the engines are rated. The gas is led to the engines through 2-in. pipes, which, at the point of entering the engine, are enclosed in the air pipes. Exhaust gases are discharged through 8-in. pipe, laid in a pit, to a concrete muffler.

Each engine has a separate muffler, which is a square box, made of concrete and placed under the ground. Above the chamber into which the gases exhaust is placed an iron grating, upon which is a bed of flint stone, to the depth of about 3 ft., the size of the stone varying from pebbles at the top to 4 or 5 in. in

diameter at the bottom. The exhaust pipe entering beneath the stone bed branches in 2 sections which have holes along the sides. Above the stone bed, an exhaust pipe leads to the top of the building, where it is turned to keep out the moisture.

The make and break system of ignition is employed in these engines, the current being supplied at 40 volts by 2 motor-generator sets, one of which is sufficient to supply both engines. In conjunction with these generators, 4 sets of storage batteries are employed.

The cylinders of the engines are cooled by means of water jackets, the water used being supplied in a somewhat special manner. After being heated by contact with the engine cylinders, the water discharges into a sump, from which it is pumped by a Yomen sewage pump, attached to a 1-hp. motor, to a cooling tower which maintains a natural draft and discharges into a big cistern. The rain water from the roof of the power house and car barn, which is nearby, is also piped into this cistern, and from there it is pumped by means of a Deming triplex pump to an elevated reservoir, 75 ft. high, with a capacity of 5,000 gal.



POWER HOUSE PLAN AND CROSS-SECTION

From this reservoir, the water is piped to the engine cylinders and the rate of flow is regulated by hand valves. To supply the water which has evaporated and other waste, a small centrifugal motor-driven pump takes water from a ravine about ⅛ mile away, pumping directly into the reservoir. The regulation of these engines is maintained within 2 per cent by means of a centrifugal governor which controls the time of sparking, quantity and quality of gas which is used.

Compressed air supplied at 200 lb. pressure per square inch by 2 compressors driven by 16-hp. Field

gas engines is used in starting the large gas engines.

Direct connected to each gas engine is a Western Electric generator of 200 kw. capacity supplying direct current at 625 volts. Each generator has 6 poles and is flat compounded and so connected that all may be run in parallel.

The switchboard is also of the standard Western Electric Co.'s make, consisting of 3 panels made of black slate, 2 of which are generator panels, and the third the distributing panel. Upon the generator panels are mounted an ammeter, circuit breakers, 3 main switches, the field switch, a voltmeter plug receptacle and a recording wattmeter. The voltmeter is mounted upon a swinging bracket at the end of the board. Owing to a steep grade at Olathe, which is 12 mi. from the power house, a storage battery, known as a chloride accumulator, made by the Electric Storage Battery Co., of 240 ampere-hours capacity, is installed at this terminal and connected so as to float upon the line.

The Arnold Co. of Chicago did the engineering work upon this plant and reports that it is operating most satisfactorily under severe conditions.

GASOLINE ENGINE DRIVING A COMBINED SAWMILL AND BRICK AND TILE FACTORY

AFTER steam had proved expensive and unsatisfactory for many reasons, H. Churchill, owner of the Buda Brick and Tile Yards, of Buda, Ill., installed in his power plant more than a year ago a 25-hp. 2-cylinder gasoline engine made by the International Harvester Co. During the winter months this plant

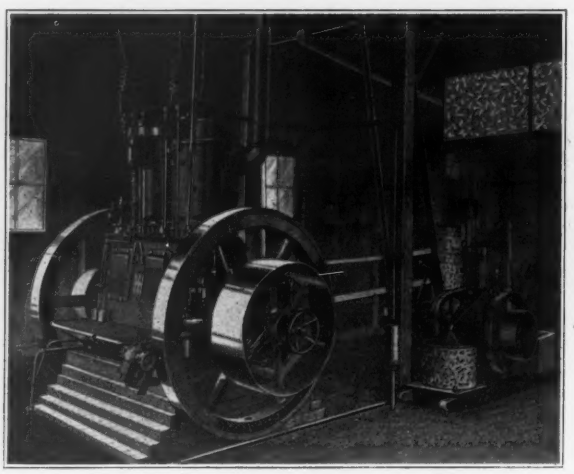


FIG. 1 ENGINE ROOM OF BUDA BRICK AND TILE YARDS

operates a sawmill of the Dixie type, made by Curtis & Co., equipped with 30 and 60-in. saws, with a mill capacity of 10,000 ft. of lumber a day and capable of handling a 4-ft. log. The service to which this engine is subjected during the period when it is operating the sawmill is extremely severe, as the load is constantly varying from no load to full load.

During the remaining portions of the year—that is, the summer months—it operates a J. D. Fate brick and tile machine, running the main shaft at 90 r. p. m. and the engine speed at 310 r. p. m. This machine has a capacity of 25,000 bricks per day, or 7,000 4-in. tile, and it requires a steady power with no let-up.

Inasmuch as the sawmill and brick machine are not operated at the same time, the engine is in a shed,

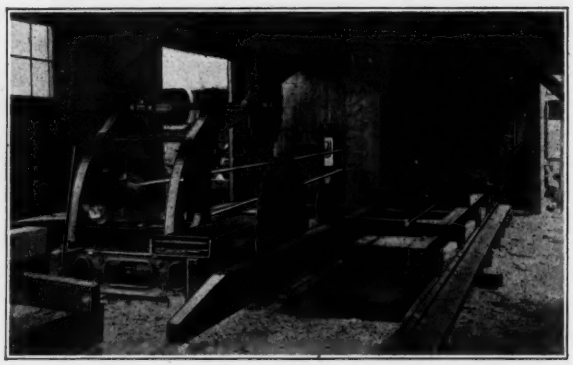


FIG. 2 SAW MILL DRIVEN BY GASOLINE ENGINE

mounted on a brick sub-base, with the sawmill on one side and the brick machine on the other, being belted direct to the machine driven. A short line shaft is provided overhead, to which is belted the air compressor and a pump.

The engine conforms in design in many instances to standard construction for vertical, single-acting, 4-stroke cycle engines. It has an enclosed crank case and splash lubrication and valves in the cylinder head are operated by push rods and rockers. A flyball governor controls the quantity and quality of mixture admitted for varying loads. This type of engine is extremely simple and all parts are absolutely interchangeable, there being no right and left in its construction.

The engine is equipped to use gasoline as fuel, although natural, city or producer gas may be used by making slight alterations. Ignition is obtained by means of batteries and auto sparkers and the results obtained are exceedingly satisfactory. The fuel consumption, according to Mr. Churchill, is about 1 gal. per hp. for 10-hr. work. Starting is accomplished by means of a simple automatic compressed air starter.

The owner is quite enthusiastic over his change from steam to gasoline engine power, for when using steam he was compelled to employ the services of an engineer, while at present one of his men looks after the engine and at the same time assists in handling brick from the machine to the driers. He states that the engine has been in service almost every day since its installation and has never failed to develop plenty of power.

PRODUCER GAS PLANT IN AN ICE CREAM FACTORY

IN THE ice cream factory of W. H. Olhaven, of Aurora, Ill., has recently been installed a producer plant which furnishes power formerly purchased from the city electric company. This change in the power system of the factory will result in a saving of $2,500 a year if the present condition of operation continues, according to the statement of the owner of the plant.

FIG. 1. GENERATING UNIT AND REFRIGERATING PLANT

The prime mover is a 75-hp. Nash gas engine made by the National Meter Co. and is of the vertical type, having 3 cylinders. Direct connected to this gas engine is a 60-kw. Western Electric generator, which delivers direct current at 220 volts. The gas to operate this generator is furnished by a 75-hp., 6-ft. gas producer made by the Industrial Power Co. of Milwaukee.

All apparatus of the plant is operated by motors which are direct connected, wherever possible, to avoid the use of belts. The machinery using power in this plant consists of an ammonia compressor, ice cream freezer, fans, etc., together with all the lights of the factory. In Fig. 1 is illustrated the generating unit and at the extreme right may be seen the refrigeration plant. This consists of a 30-ton ammonia compressor, belted to a 40-hp. motor. It furnishes all refrigeration necessary for the cold-storage room besides that needed for making 13.5 tons of ice daily. The indirect system of refrigeration is used for the cold storage room and the can process is employed for making the ice.

The switchboard which is shown in the illustration has mounted upon it a voltmeter, ammeter, and recording wattmeter besides the necessary switches for the circuit, and also the necessary gages for the ice machinery.

The ice cream freezers, which are 4 in number, are shown in Fig. 2. The cream which is mixed in a tank in the storage room above is drawn by means of gravity to the freezers, in which it is surrounded by a jacket through which is circulated the freezing brine pumped from the refrigeration tank.

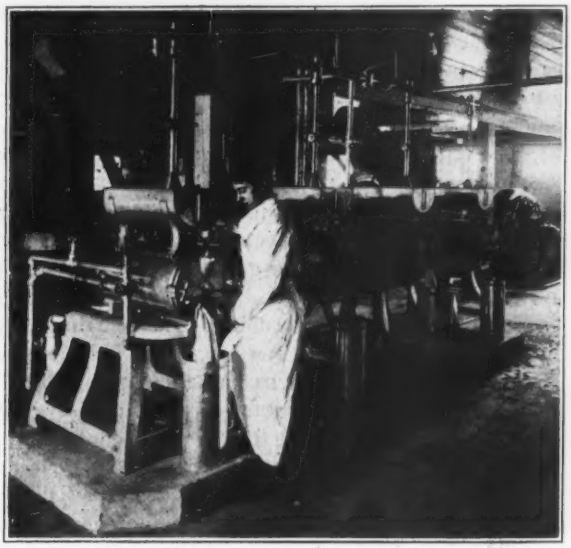


FIG. 2. ICE CREAM FREEZERS

After the cream has been frozen, it is taken in cans

to the cold storage room, where it is kept awaiting sale or shipment. In a separate compartment is a cupboard with a capacity of 300 gals. in which the brick ice cream is frozen.

The load of this factory is steady, which, together with the economy realized, makes this type of prime mover admirably well adapted to the service.

AN OPERATING TEST ON A GAS-ELECTRIC POWER PLANT

TO THE engineer, the value of any type of engine or power plant in general is made evident only through a test conducted by a competent man upon that plant or one working under similar conditions.

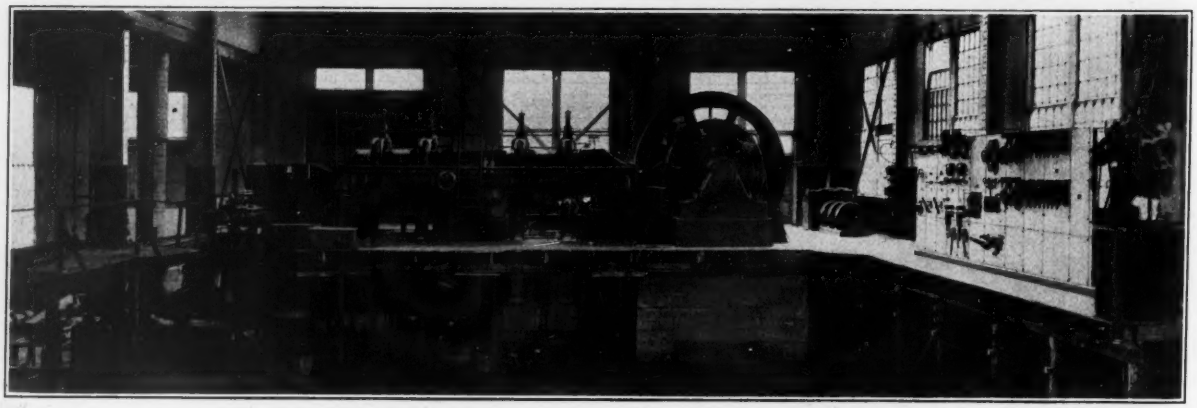


FIG. I. ENGINE ROOM OF AMERICAN LOCOMOTIVE CO.'S RICHMOND WORKS

In this article we give some interesting data which were the result of a test conducted by William Dalton, chief engineer for the American Locomotive Co., and presented in a paper before the American Institute of Electrical Engineers by J. R. Bibbins of the Westinghouse Machine Co.

The Richmond plant of the American Locomotive Co. upon which the test was made has an equipment consisting of a 23.5 by 33-in. horizontal, tandem gas engine, with a direct-connected, direct-current generator, operating on producer gas generated by a pair of 9-ft. bituminous producers. The gas is purified by means of wooden slat scrubbers and centrifugal tar extractors, motor-driven. A 15,000 cu. ft. holder serves to equalize its quality and to start the engine, which is necessary to bring the motor-driven auxiliary into service. The engine is of the modern double-acting type, giving 2 impulses per revolution, and is governed by a sensitive oil relay system designed to relieve the governor of all valve work. Employing the constant quality method the ratio of air to gas is constant except when the gas itself changes, for which event hand-regulated dampers are provided.

Duplicate igniters work together for increased security. For the same purpose duplicate sources of igniter current are available—motor-generator and lighting mains. An important feature of the producer is that it is designed for continuous operation, having a water-sealed bottom instead of a closed ash pit, to permit the removal of ash at any time. It generates its own steam, requiring no auxiliary power, so that the only auxiliaries required for the entire plant are a motor-driven fan, tar extractor, and igniter set. In the aggregate, these auxiliaries absorb about 5 per cent of the station capacity.

The Richmond works employ motor drives to a considerable extent, and for such diversified purposes that the individual demands superpose to a large degree and yield a fairly constant total. This is a condition conducive to the most efficient working of a gas power plant, and influenced to some extent the choice of this form of motive power in this particular location. The main service plant of the Richmond works is called upon for continuous 24-hr. service, except on Sundays and holidays.

The test was conducted on a continuous run of 223 hr. duration at full load, 125 hr. at three-quarters load

FIG. 2. PRODUCER PLANT AT RICHMOND WORKS

and 136 hr. at half load. It was entirely in the hands of the company's engineering and operating staff and for the purpose of determining the fulfillment of guarantees. The electrical output was measured by a calibrated direct-current recording wattmeter. The water

consumption was also metered, no great accuracy being desired, and the coal was weighed by scales checked from time to time by standard weights.

General Results of Test

Nominal Load.	Full.	Three-Quarters.	One-Half.
Length of run, hr.....	223	125	136
Average load, kw.....	312.3	228.3	159.6
Average load, computed brake hp.	455.0	333.0	238.0
Load, per cent engine rating	91.0	67.6	47.5
Load, per cent generator rating	104.0	77.2	53.2
Coal gasified, lb.....	115,289	54,143	47,775
Coal gasified per hr.....	517.0	433.0	351.0
Output, kw.-hr.	69,650	28,540	21,710
Lb. coal per kw.-hr.....	1.654	1.697	2.20
Lb. coal per kw.-hr., guaranteed	1.93	2.10	2.64
Lb. coal per brake hp.-hr....	1.14	1.31	1.56
Avg. heat value of coal, B. t. u.	14,392	14,392	14,392
B. t. u. per kw.-hr.....	23,700	27,280	31,650
B. t. u. per brake hp.-hr.....	16,415	18,710	21,670
Per cent thermal efficiency, brake	15.51	13.6	11.75
Per cent thermal efficiency, elec.	14.35	12.65	10.78

Coal.—Pocahontas run-of-mine; avg.. heat value dry sample, 14,703, as fired, 14,392; volatile matter, 22.8 per cent, ash 4.5 per cent, sulphur 1 per cent.

Test.—August 12, 7 a. m., to September 7, 12 m.

The general results of this test are tabulated in the table. From these results and others obtained, it is plainly evident that the plant does its best work well loaded, for it was determined that it required over ⅓ of the full-load coal to run the plant unloaded. This represents a standing charge against the operation, becoming less and less important as the load increases.

Barring this constant loss this plant would be capable of generating power at the rate of 1 lb. per kw.-hr, which rate would, moreover, be constant at all loads. In other words, an additional load might be acquired at this rate by providing for the constant losses at a fixed charge. This method is actually employed by some central stations in determining power rate.

A remarkable feature of the producer plant is the low rate of standby losses, averaging in this case only 46 lb. per hr. or 2.5 per cent of the weekly coal consumption. This statement is based upon the coal consumption during the days when the plant was not in operation, that is, Sundays and holidays.

A careful measure of oil consumption was made during the 2 weeks' run at full load, comprising 223 hr. operation, also the water consumption of the engine. During this period, the average rate of cylinder oil consumption was 0.09 gal. per hr., or on the basis of a 10-hr. working day, 4.9 gal. per week. The high economy of oil is due to the system of timed, forced circulation employed.

The average quantity of cooling water used was 6.56 gal. per brake horsepower-hour at heavy load, with inlet temperature varying from 75 to 80 deg. F. and outlet from 140 to 150 deg. F. This quantity is quite reasonable for the temperature rise. Economy of water may be carried to any reasonable point provided the outlet temperature of any part does not exceed 150 deg. F., the upper limit only being important.

It is a quite general impression that the gas power plant must be handled with a considerable degree of care in order to obtain good results, but this opinion would not be justified from the results obtained by this test. Throughout the week of continuous operation, 24 hr. a day, a particularly high average load was sustained and the normal run at this plant is 6 days without a stop. It is a noteworthy fact that the producer fires remained undisturbed for a period of over 6 months when an opportunity occurred to make careful inspection of the entire equipment.

From the preceding data and other items of cost, the cost of power was estimated at various load factors. Owing to the fact that the present equipment was made to accommodate a 2-unit plant, the cost was computed upon this basis; and in view of the excellent results that have been obtained the electrical rating of the plant has been placed at 700 kw. or 1,000 hp., at which rating the investment cost becomes about $138 per kw., or $96 per brake hp. complete, including building, foundation, piping, erection, in fact all items except the value of the land occupied.

Considering the limited size of the plant this does not represent an extensive cost, which in large plants would probably be as low as $100 to $125 per kw.

As in this case, only an industrial plant is considered in which the load averages practically uniform throughout the day, it suffices to estimate power costs at full and half loads respectively. The results show that with the price of fuel at Richmond, $2.70, power can be delivered at the switchboard at a cost of ⅔ cent per kw.-hr. for a fully loaded plant, operating 7,200 hr. per year, or less than 1.25 cents operating at half load, and this taking into account fixed charges which range around 40 per cent of the total cost. Even with coal as high as $6 per ton, the total cost of power would be less than 1 cent per kw.-hr., obviously an excellent result.

FIGURES COMPILED BY THE Pennsylvania Railroad show that out of a total of 369,315 trains of which a special record was kept during the year 1908, 324,739 trains, or 88 per cent of the total, made scheduled time or better.

FOR FINDING THE LENGTH OF BELTS an approximate rule is add the diameters of the 2 pulleys, and multiply by 1.5625. Add to the result twice the distance between the centers of the shafts and it will give the required length.

LONDON LETTER

Gas Engine Progress. Use for Ships. Liquid Fuel

BY W. A. TOOKEY

WHEN it is remembered that the first practical gas engine (Lenoir) appeared less than 50 years ago (1860), the position held to-day by this form of motive power seems almost incredible. Undoubtedly, it is to the convenience and advantages of steam power and the assistance it has rendered to engineering progress during past years, that the gas engine, to a very great extent, owes its rapid advancement. As in accordance with the general laws of the universe, each fresh generation displaces the older to which it is indebted for its infant nurture, so it seems that gas may eventually supersede steam.

There are, however, many problems yet to be solved before steam power will be ousted altogether from its present position, both for land and marine service. In the latter, particularly, it has been said that the evolution of the steam turbine has saved the situation. Turbine enthusiasts have been tremendously eager to impress their views as to the superiority of these engines for marine propulsion, and have made many fanciful and extravagant claims which, to put it mildly, are not supported by those whose duty it is to work the ships thus fitted. The most efficient turbine is that which makes the greatest possible number of revolutions a minute, while the most efficient propeller is that which makes the least possible number of revolutions a minute; a most unhappy combination which, a correspondent of a Glasgow journal points out, has caused, and is causing, peculiar difficulties of a very disquieting nature to those who are connected with turbine propelled vessels.

In the old days of non-condensing marine engines running at slow speeds, it was not at all a rare thing to find that, after 20 or 25 yr. service, the propeller was practically in as good condition as when first fitted. With compound condensing engines, running at about 50 per cent higher speed, not only was it found that the propeller efficiency fell off, but the tips at the back of the propeller blades showed signs of pitting. Not a very serious matter in itself, but involving rapid deterioration. With high-speed turbines, the pitting is much more serious, as the defect is apparent across the face at the root of the blades, and thus another risk of breakdown is added to the many already existing.

Needless to say, these troubles will be carefully watched, but from all appearances it seems likely that as the steam turbine is best suited to quick running machinery and particularly for large central electric station units, in the future its application will be limited thereto. If this be so, the gas propelled boat seems likely to become an accomplished fact sooner than seemed possible a little while ago.

Meanwhile, steady progress is being made towards surmounting the difficulties connected with reversing, as well as with regard to the provision of special arrangements for giving the necessary attention to cleaning and adjustment of detail parts without a great amount of disturbance to the main frame in the confined positions inseparable from marine service.

One Manchester firm has recently patented a reversing arrangement in which 2 separate engine units rotate in reverse directions. One unit constantly revolves in one direction and is connected to the propeller, at will, either directly or through reversing gear. The second unit is reversible and is connected to the crank-shaft of the first in such a manner that, for reversing, it is brought to rest and afterwards restarted in the required direction by the constant direction unit, either by direct or intermediate gear as may be necessary for the purpose.

Yet another method has been patented by a Glasgow firm in which an electric motor is used. The latter is reversible and is connected with the crankshaft of the engine through the intervention of a magnetic clutch, which is automatically disengaged after a certain speed has been attained, in either direction, by the main engines, and is automatically re-engaged when the speed falls below a certain limit, suitable valve gear being provided on the engine to permit operation in both directions.

But while these difficulties are being wrestled with for marine service, the gas engine is steadily forging ahead for ordinary industrial service, owing to the modification of the gas producer to burn cheap fuel of all kinds. Shavings and small pieces of waste wood have been used satisfactorily for some time in connection with the woodworking industries.

In districts where twigs and small branches are procurable, charcoal can be made easily and is already largely utilized in New Zealand, Jamaica and elsewhere, while experiments recently completed show that refuse cottonseed yields good power gas. In Lagos and Mombasa, in South Africa, trial plants have already been sent out, and as the cost of coal is prohibitive, while seed is, at present, of little or no value, great developments may be expected, not only for providing power for the ginning and baling factories, but also pumping, and local industries.

Still another development is recorded from Ceylon where gas is produced from cocoanut shells. In one factory a month's work on 1.5 million nuts, not only involves a serious nuisance with regard to the disposal of refuse, but also a constant risk of fire. A gas engine can be kept in operation for driving all the machinery, giving out useful work from this waste material at the rate of 2.5 to 3 lb. per horsepower-hour. The gas is reported to be equal to coal gas as regards output of power from an engine of given dimensions.

Among liquid fuel engines, those working on the Diesel principle, are being adopted extensively. During the last few weeks some very interesting information has come to hand from consulting and operating engineers, relative to the performances in everyday op-

eration. At Leatherhead, 2 120-hp. Diesel engines have been working in the local electric light station for more than 3 yr., and the cost of repairs has amounted to only $9.60 during that period. Notwithstanding the high cost of oil, from $15 to $16 a ton, the working costs per kilowatt generated per hour amount to only 0.58 cents, whereas, with the steam plant previously in service, the figure was 2.09 cents.

One disadvantage to their general application is the great variation in the cost of fuel, and yet another in the high initial outlay. In some cases, it has been found cheaper to install gas engines and producers simply on account of the charges of interest on capital, and depreciation, swamping the possible saving on the cost of fuel.

A practical point of prime importance was brought out during a recent discussion with reference to the method of supplying the oil to the various cylinders. In the earlier types, a separate fuel pump was provided for each cylinder, but this has since been abandoned by European makers in favor of a single pump for all cylinders. It is preferable however, to use one pump with a separate plunger for each cylinder, as an equal distribution of fuel at all loads can thus be ensured. Besides which, one or more cylinders can be cut out when under light loads by simply propping up the suction valve under any particular plunger. This enables an engine to work under practically uniform full load conditions as far as one or more cylinders were concerned, and therefore, at its highest efficiency throughout a considerable load range, the remaining cylinders being put in as the load increases.

Two-stroke cycle Diesel engines have not yet been found satisfactory although first made 7 yr. ago. Owing to temperature limitations, 2-stroke engines can be run only at half speed, and therefore, no adequate advantage is secured by departing from the four-cycle type.

HUNTING FOR STEAM LOSSES

By E. G. Tilden

LOOKING for the whys and wherefores of unsatisfactory performance of steam machinery always had a fascination for me and the story of what was done in one case and the outcome may be of interest.

The installation consisted of 3 horizontal tubular boilers equipped with mechanical stokers, a pair of

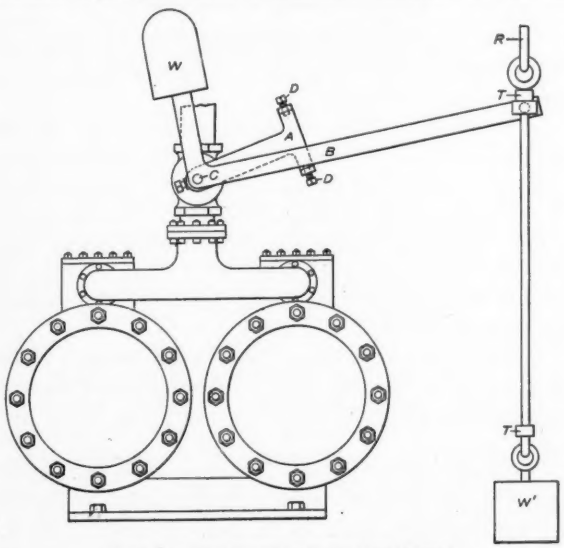


FIG. 1. PUMP VALVE MECHANISM

automatic horizontal engine generators, hydraulic passenger and freight elevators of the old-fashioned gravity type, 2 deep-well pumps with the usual "mess" of boiler feeders and house pumps.

At the outset I was called on for an approximate estimate of the amount of coal that the plant should get along with, and after going over everything carefully I named a figure that I thought could be gotten inside of easily, only to find that I was some $200 a month lower than the best previous record. A second going over seemed to prove the correctness of my first estimate, and the situation was an incentive to "get busy" as we say nowadays.

The usual category of setting valves, refitting worn steam traps and repairing visible leaks resulted in bringing the coal bill down where it usually had been, but bringing it down to my estimate seemed to require something more in the way of fixing.

Controlling the Elevator Pump

Our passenger elevator pump, a big duplex was a steam eater, and a study of the situation developed these facts: The speed of the pump was governed by a chronometer valve to the lever of which was a rope running to a float in the roof tank. The pump plungers were metal packed, gray iron plungers working through brass bushings, and passed water enough to allow the pump to move slowly without actually pumping any water so that no matter how long the elevator might be idle the pump never came to a dead stop, which fact led to the valve mechanism shown in Fig. 1 being evolved, the idea being to run the pump at a fair rate when water was wanted, then shut it down dead until more water was wanted.

Piece A was fastened by a set screw to the valve stem C, in place of the old lever, while the angle lever B, was a running fit on the valve stem but engaged the set screws D D, the upright part of B carrying weight W.

Motion from the float in the discharge tank was communicated through rope R to the rod carrying the tappets T T and the weight W', the distance between tappets T and T being sufficient to allow the arm B to swing free, until a shoulder on the hub of A struck a stop on the body of the valve; that is to say, when

the float in the tank moved lever B to a point where weight W toppled over the center to the right, lever B would slide down rod E until A brought up against a stop on the body of the valve, in which position the valve edges would overlap the ports and the pump would stop.

On the other hand, when the float pulled the end of lever B high enough to topple weight W over the center to the left, piece A would be moved over against the wide open stop thus giving the pump all the steam that was being supplied at that point, which amount was governed by a nearby globe valve in the steam

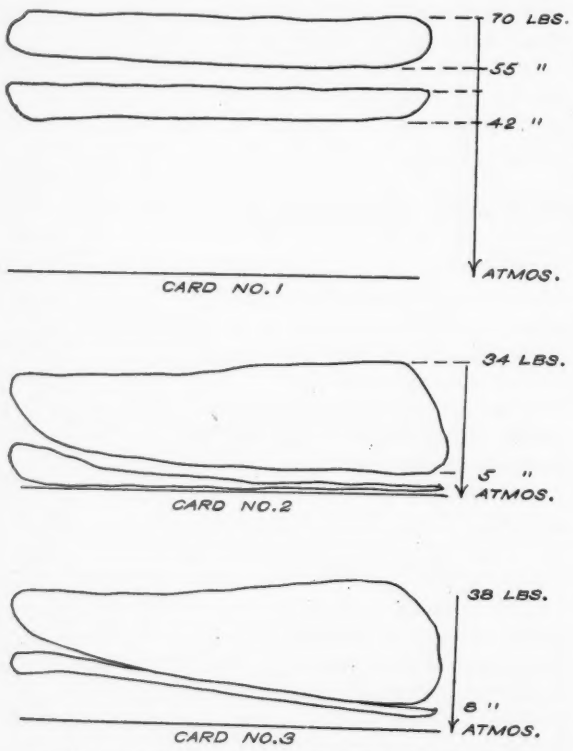


FIG. 2. DIAGRAMS FROM DEEP-WELL STEAM PUMP

pipe, set by hand, to run the pump at a suitable speed.

The tank on the roof held water enough to run the elevator several trips and it was no uncommon thing for the pump to stand still for an hour or more.

That arrangement took off about $2 a day from the coal bill. Of course, standing for any length of time meant getting cold and condensing some steam, but a trap in the drain pipes from the cylinder cocks kept the steam cylinder free and delivering the discharge from the trap to the boiler feeder, first passing it through an oil separator, saved the hot water.

Hot Flue Gases

Putting a pyrometer into the smoke box of one of the boilers disclosed the fact that the flue gases were going to the stack at a temperature of 1275 deg. F. First we wondered what could be wrong with the pyrometer, then it was a question of how much of the excess heat was leaking through the arch over the fire, but repeated experiments finally convinced us that the heat indicated by the pyrometer was actually coming through the tubes.

A damper in the breeching between the boilers and the base of the stack, brought the flue gases down to about 550 deg. F. and we then had to change the setting of the governor on the stoker engine in order to slow it down to fit the new rate of aid supply—this made another reduction in the coal bill.

More Room for Combustion

The next move was an experiment on the boiler settings. In those days it was the practice of the builders of the stokers we were using, to run a brick paving from the level of the top of the bridge wall straight back to the rear end of the boiler, then drop down to the floor level, thus providing a sort of a pocket for the light dust to settle in; the brick paving at the rear was within about 12 in. of the boiler shell.

Just to see what would happen we tore this paving out of one of the settings, digging out the filling to the floor level from the rear wall right up to the bridge wall.

A test showed that the big combustion chamber added materially to the efficiency of the stokers so the other 2 were arranged in the same manner.

Peculiar Pump Adjustment

Putting an indicator on a 7 by 36 in. deep-well pump led to a surprise party in the shape of a peculiar cushion valve adjustment.

Card 1 shows the steam distribution due to the cushion valves in the exhaust ports being closed almost entirely. On the up stroke the initial pressure was 70 lb. while the back pressure was 42 lb. On the down stroke, notwithstanding the fact that the pump rods weighed some 1200 or 1500 lb., required an initial pressure of 50 lb. to push the piston down against the back pressure of 55 lb.

Under these conditions the pump developed 16 hp. at a cost of $1.25 a day, the actual horsepower required to raise the water delivered by the pump being only 2.1.

In card 2 the water was delivered at the least steam consumption but the steam piston would strike the bottom cylinder head, so we had to back up to the setting shown by card 3. Under these conditions the gross horsepower developed was 7.8 at a cost of about 70 cents a day.

These figures appear on the original cards but I do not recall whether total steam consumption or only that accounted for by the indicator is comprehended—in any event the value lies in the comparison.

The discharge from the deep-well pump was into a tank in the basement from which either one of the 2 house pumps would deliver the water to the house tank on the roof.

A House Pump in Distress

One of these house pumps was about the right size but the other was entirely too large for the work, and to make it all the more interesting the large one needed repairing badly. The ball on the stem of the throttle had become deranged and there was no way of shutting off the steam except at the main valve on the steam header which meant shutting down everything in the house, even to the engines driving the lighting generators—this was apparently out of the question as the house, a hotel, was not piped for gas and we had no outside electrical connection.

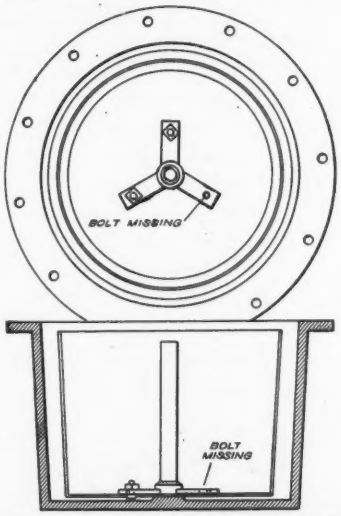


FIG. 3. FLOAT POT OF THE STEAM TRAP

It was finally decided to get that pump out of service somehow. A new valve and other fittings were procured, and after all necessary preparations were made, the night clerk was notified, after it was too late to get to the proprietor, that on the following morning from 2 o'clock to about 4 there would be no electric lights, together with the suggestion that it might be well to provide a few candles or oil lamps.

The gentleman stormed and fumed after the manner of his kind but the lights must have gone out for the next morning that pump was as quiet and peaceful as could be. One of my co-laborers said, "I've been working here over 3 years and that's the first time that pump has been stopped since I have been on the job."

In a bunch of 5 or 6 steam traps the connections to which ranged from 0.5 to 1.25 in. was one, the condition of which was so incongruous that it will bear describing. It was an ordinary trap, having the usual cast-iron floating pot as shown in Fig. 3. The central tube was fastened to the bottom of the float by means of a 3 prong crow foot bolted in place, but one of these bolts was missing, thus leaving a 0.5 in. hole in the bottom of a cast-iron kettle, that must float in order to close the valve.

Doing the best we could with existing apparatus enabled us to cut a $27 a day coal bill down to $10 a day.

A PRACTICAL TALK ON ENGINE BEARINGS

By A. E. Palmer*

In considering the subject of engine bearings, the questions of projected area per pound of pressure and lubrication arise as probably the most important points to consider.

It is well known that the amount of friction is independent of the area of the surface in contact and is dependent upon pressure and the nature of the substances. In the case of engine bearings, friction is an undesirable element to have lurking around and the more it is gotten rid of, the better for the engine. It is also well established that 2 like metals in rubbing contact will produce more friction and will "freeze" quicker than 2 unlike metals under the same conditions. For instance, a steel shaft running in a steel bearing is far more likely to run hot than a steel shaft in a bronze or babbit bearing of the same area.

Lubrication by introduction of an oil film between the surfaces in contact serves to reduce the friction between them but does not, of course, entirely eliminate it. Ball bearings are perhaps the nearest thing to frictionless, but are not entirely so. There is a limit of pressure beyond which the oil film is not effective as it is squeezed out from between the surfaces and allows them to come into direct contact with each other; that is, metal to metal. A certain number of pounds per square inch of projected area is the rule governing the design of all bearing surfaces, varying, of course, with conditions. Some engines suffer from lack of main bearing area while others are overburdened with it.

The crank shaft bearings are the most important and besides being of correct area, they should be supplied with the amount of lubricating oil necessary to keep the bearing from running hot. If a bearing becomes slightly warm, it is not an indication of incorrect design, but on the other hand this feature may be advantageous especially when using grease cups as the small amount of heat has a tendency to melt the grease, bringing it to a fluid state and allowing it to run freely. It must be remembered, however, that all this heat is dissipated energy and must not be carried too far.

Oil pockets should be provided in all main bearings, either in the form of chipped grooves or small holes drilled in the metal. Some makers prefer one method, some another, but suffice it to say that these oil feeders should be there in some form or another.

The babbit bearing has its good place in the mechanical world and the writer is partial to this type for the following reasons: it has excellent wearing qualities, antifriction properties, is easy of replacement and last but not least, is cheap.

Doubling the diameter of a pipe increases its capacity four times.

*Mechanical Engineer, The Ferro Machine and Foundry Co.

ELECTRICAL MACHINERY AND APPARATUS

CARE OF COMMUTATORS*

By T. E. Chappell

TOO little attention has been paid in the past, among users of electricity, to the commutator. One does not have to travel far among electric plants to discover that commutators are operated under conditions detrimental to the life of the commutator and unfavorable to the economy of current.

Excessive sparking and the development of flats are believed, very generally, to be necessary evils, which must be endured, since they cannot be cured. Sparking wastes current and also "burns" the copper, thereby developing "pits," which further aggravate the sparking. By this process of softening the copper, "flats" are developed, which make it impossible for the brushes to get full contact with the surface of the commutator, hence defective commutation and loss in efficiency.

Besides the disintegration of the bars due to sparking and burning, waste of current, and loss of efficiency due to poor contact of the brushes, there is much trouble caused by increase of temperature of the adjacent parts of the generator, and particularly in the outboard bearings.

Again the commutator will get so hot from bad brush contact, that the solder in the lugs is often melted, causing the armature to show partial opening, which means a flat bar. This, if not remedied promptly, will extend to the next bar and so on around the commutator. There is also great danger of injuring the insulation and winding of the armature core, thus decreasing the efficiency of the unit and often necessitating rewinding the armature.

The fact is a whole troop of troubles in motors and generators are directly traceable to lack of knowledge of the commutator, or negligence in the care of it. The condition of the commutator determines the efficiency of the unit in service. A true periphery and a perfectly smooth surface are the 2 prerequisites to satisfactory service of the commutator.

Truing

To secure these is the aim of all commutator truing, and commutator truing devices. There are 2 methods now recognized in the truing of commutators. The tool and slide-rest has been long in use, and, supplemented by the "stone" and "sand paper," is familiar to everybody who has anything to do with commutators. The recognized defects of this device are: That the cutting-tool breaks the mica instead of cutting it, and drags the copper into these breaks; the tool does not give a perfectly uniform surface, the copper bars being left a little higher in the center than the general level of the commutator; this tool can be used only at low speed and therefore does not true the commutator as it runs in service; it is necessary to take a thick cut with the tool to get the required "bite" for even cutting; hence, the tool must be supplemented by a constant use of stone or sand paper; on account of having to run slowly it is extremely difficult to maintain a uniform rate of revolution, and it is not easy to prevent the tool digging into the bars under this uneven speed, and frequently great damage is done a commutator in this way; the cutting edge wears rapidly, and must be replaced by another or reground during the process of truing, and in this way a "score" around the commutator is always left, which can be removed only by taking another cut off the whole of the commutator. This results in a waste of copper and so decreases the life of the commutator; moreover, as the tool wears under the stress of cutting, you produce a taper which is objectionable.

Grinding

Grinding is the only present alternative to the cutting tool. A little reflection on the part of anyone familiar with machine tools will show that grinding by means of 2 revolving surfaces is almost the only way of securing a perfect periphery.

In the case of the commutator, the mica bars are of necessity ground to an even surface with the copper bars. There is no breaking or tearing of the mica and no dragging of the copper. The cutting wheel runs at such high speed as to make a perfectly clean cut of both mica and copper, and it is only necessary to build a cutting wheel which will not fill with copper and which will afford the required cutting efficiency.

A cutting wheel has been produced by a composition in which no mineral substance appears. This wheel, unlike the common emery wheel, will grind indefinitely without gathering any copper. It is possible to true a commutator running at its normal speed which insures that it will run true in service, and it is possible to grind a commutator in about one half the time that it takes to turn it down with the cutting tool. There is also time and expense saved in the matter of attaching the device to the commutator.

Of greater advantage still is the fact that an efficient commutator grinder makes "sanding" or "stoning" unnecessary. By using a coarse wheel to take off the first rough cut, followed by a finer wheel for smoothing up and by a polishing wheel for glossing, you secure a perfect periphery, and at the same time a surface like glass.

The fine polishing wheel will take out incipient flats and every time you touch the commutator you

*Read before the National Association of Cotton Manufacturers.

leave it with a true periphery and a perfectly smooth and even surface. It should never be necessary, therefore, to take off the deep cut now required periodically to take out the bad flats that will develop in spite of applications of sand paper or stone. A fraction of the time now spent in sanding or stoning will keep the commutator true and render turning down, with the expensive waste of copper, unnecessary.

Actual experience with grinding has shown conclusively that the greater part of the commutator troubles mentioned can be easily and cheaply prevented; that sparking, flats, imperfect brush contact, over-heating with the damage to bearings and armature windings, with attendant sanding and stoning, and periodical butchering with the tool, are not necessary evils. A small part of the time now spent in more or less fruitless efforts to remedy these commutator defects will prevent them altogether.

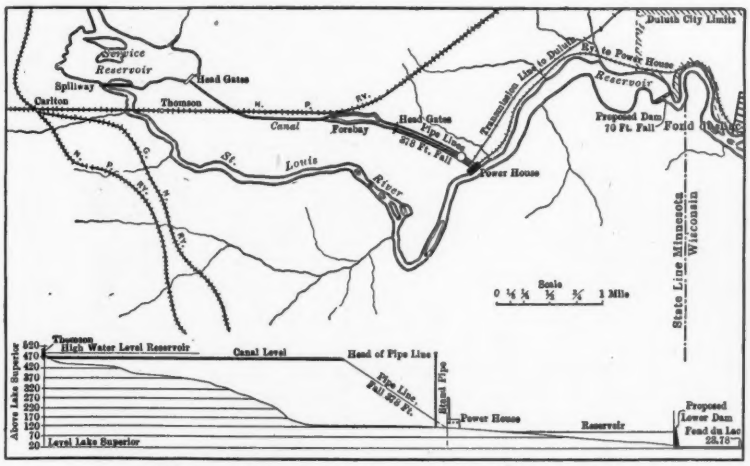


FIG. I. MAP OF ST. LOUIS RIVER DEVELOPMENT

A BIG WATER POWER PLANT

Development of water powers is one of the most extensive of the movements for conservation of national resources. One of the biggest of these is that of the Great Northern Power Co. on the St. Louis River, near Duluth, Minn. The river drains a territory of about 3,700 sq. miles, and near Thompson, Minn., it begins a descent of 464 ft. in 8 miles, which has been taken advantage of by this improvement. A concrete dam has been constructed, 1,120 ft. long with an additional 1,000 ft. of spillway formed by dressing off the top of a natural ridge of slate rock.

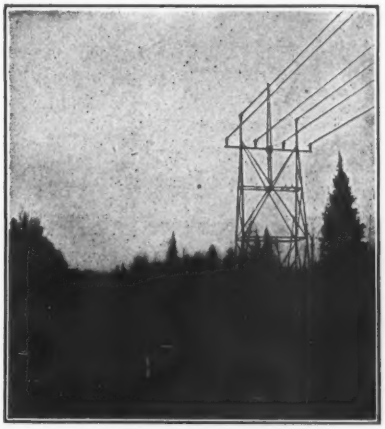


FIG. 3. PART OF THE TRANSMISSION LINE TO DULUTH

The power house is located 3 miles from the reservoir thus formed and from this a transmission line is carried to Duluth. A canal carries the water for a mile and a half, where it discharges into a fore-bay and for the last 5,000 ft. a pipe line is carried, the first 4,000 ft. being of wooden staves, the last 1,000 ft.

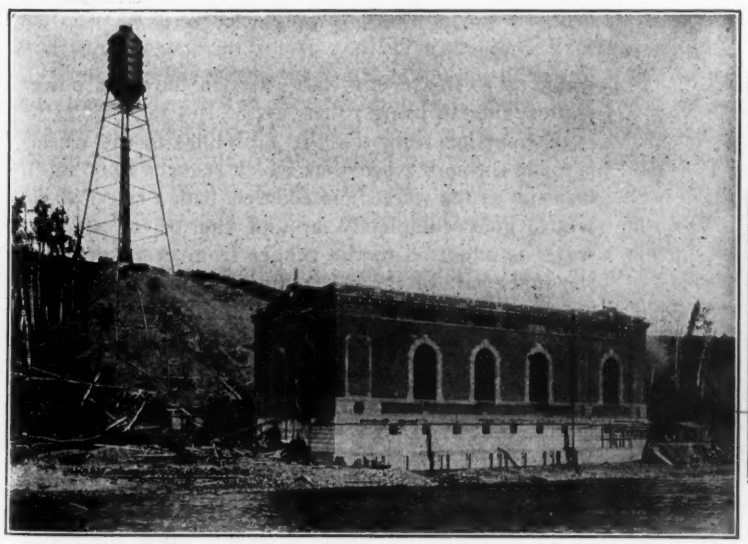


FIG. 2. POWER HOUSE WITH STAND PIPE AND TANK ON BLUFF

FIG. 4. SECTION OF STAVE PIPE LINE

of riveted steel. The capacity of canal and pipe lines is sufficient to supply 80,000 hp., the flow being at the rate of 3 ft. a second. Three pipe lines are at present installed and a place is ready for a fourth. Each penstock is 7 ft. in diameter and supplies water for a full load of 13,500 hp. on its turbine unit. The power house is situated on the bank of the river below a bluff and at the top of the bluff the pipe lines are connected to a cross receiver from which a 6-ft. standpipe

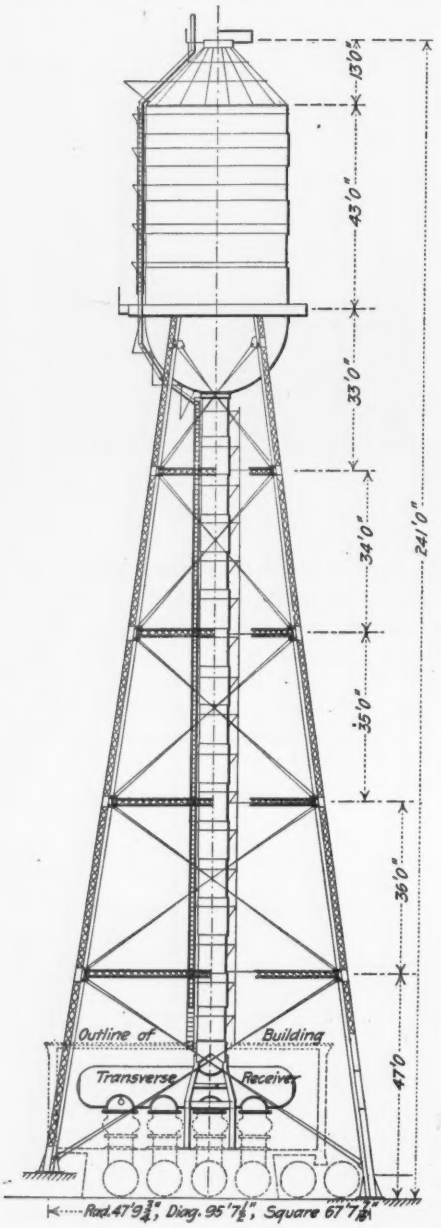


FIG. 5. TANK AND STAND PIPE CONSTRUCTION

rises to a 30-ft. tank. The tank itself is 52 ft. high and its top is 250 ft. above the foundation of the structure, the object of this pipe and tank being to keep an even pressure on the end of the pipe lines at all times and to avoid surges.

Freezing of the tank and standpipe is prevented by a current of hot air rising in a space between the pipe and lagging, this air being supplied from a heating plant near the power house. The present power-house equipment is 77 by 181 ft. and is half the development which is contemplated when the plant is complete. The present building has room for 4 vertical turbine units of 13,500 hp., each built by the Allis-Chalmers Co. and each unit driving a 7,500-kw. vertical 3-phase generator which furnishes current at 25 cycles. All of the head developments are sufficient for the complete plant as planned, the only additional installation needed being building, pipe lines and generating units. It is proposed also to build 3 miles lower down the stream another dam and power house which will back

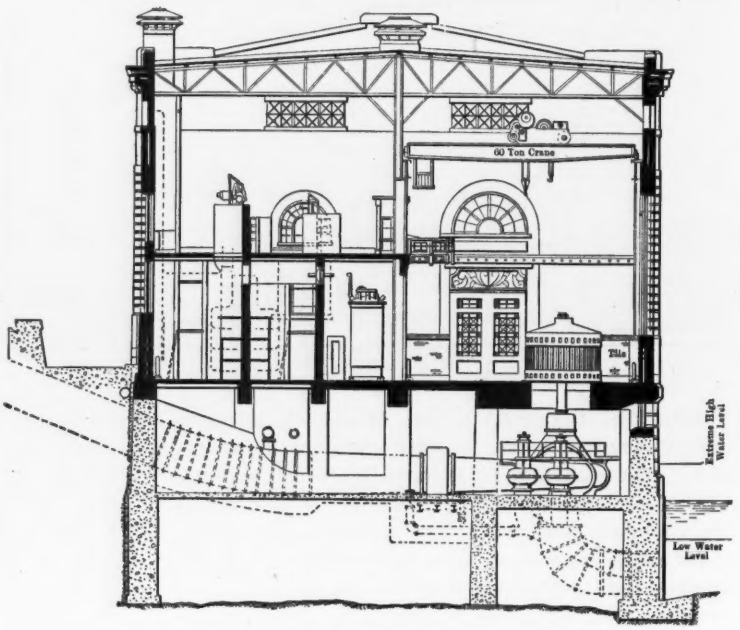


FIG. 6. SECTION OF POWER STATION

water up to the level of tail water in the main power station, the fall being 70 ft.

Connection from the 7-ft. pipe lines to the wheels is made through a penstock which reduces to 66 in. in diameter at the wheels and connects with a spiral casing which goes completely around the wheel, so that water is admitted to the runner from every point on the inner side of the case. Fixed guides are held in an annular casting and inside this casting are movable guide vanes or gates for the control of the amount of flow. The position of these gates is determined by a flywheel governor driven by the turbine. The revolving field of each generator is mounted on the vertical shaft of the wheel, the whole weight being carried on an oil pressure thrust bearing on the shaft. Each unit has an individual oil pump with a complete system of piping to supply oil to the thrust bearings. Pumps are 2-stage machines of the mesh-gear type, each stage being arranged to raise the pressure 200 lb. so that oil is delivered at 400 lb. per sq. in. if desired.

Current is stepped up for transmission by 75-kw., 3-phase transformers, which are oil insulated and water cooled. These are monster pieces of apparatus, standing nearly 15 ft. high, being 15 ft. long and nearly 6 ft. wide. They are wound to raise voltage to either 30,000 or 60,000 volts, as desired. The steel power transmission line carries the wires of the station to the substation in Duluth, 14 miles away, where the current is stepped down 13,200 volts for distribution to customers in Duluth and Superior.

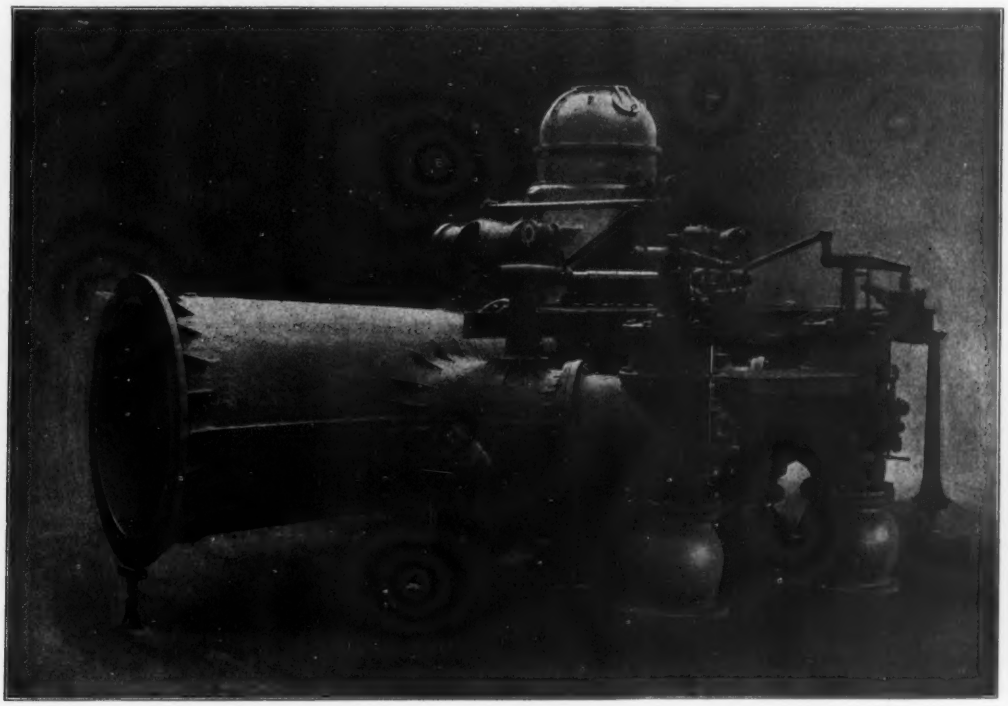


FIG. 7. ALLIS-CHALMERS TURBINE WATERWHEEL OF 13,500 HP.

Contracts have been made for supplying power to all street railways and electric light and power companies in the vicinity of Duluth, besides the pumping station of the Duluth Water Works, the American Carbolite Co. for the manufacture of calcium carbide, and many large coal docks and manufactures of various kinds.

An interesting fact in this connection is that Duluth is now the third largest shipping port in the world, so that the demand for power there is considerable, and with the completion of this power development the manufacturing interests are likely to have a great impetus. More complete information in regard to the dimensions of the development are given in Bulletin No. 1,613, issued by the Allis-Chalmers Co., of Milwaukee.

RUST PREVENTION

Rust forms not only on iron exposed to the air and moisture, but on iron set in brick or concrete, or under water. Everything made of iron or steel is liable to oxidation and therefore loss in appearance and strength.

While efforts at rust prevention have been centered in the problem of preserving structures built of steel, many other interesting phases of the same problem have been claiming attention as well. One of these demands for a rust preventive comes with the necessity of protecting machinery and miscellaneous shipments of iron during transportation to different parts of the country and in storage afterward when awaiting use. It is necessary to give the steel such a coating of water-shedding material as to form a rust-preventing, impervious layer over the surface exposed. The substances used have been those least susceptible to the influence of atmospheric oxygen, and consequently with the smallest tendency to form fatty acids, because these acids attack the metal and form with it a composition of a rusty brown color. Though tallow is a fat often used for greasing the surface of iron, it is one that very soon becomes converted into a rusty brown mass, and allows the iron to rust. Mineral oils give better results than either vegetable or animal fats.

One preparation which has been successfully used for years in this particular field is known commercially as Anti-Rust, prepared for the market by F. L. Melville, New York City. This product is semiliquid in form, easily applied and not affected by changes of temperature. It is readily removed from the surface treated without resorting to the use of benzine or other cutting agents, and has given notably good results in the protection of iron from the corroding influence of salt water and in long continued open air tests.

PRACTICAL ENGINEER

PUBLISHED ON THE FIRST OF EACH MONTH
at 355 Dearborn Street, Chicago, Ill., by the
TECHNICAL PUBLISHING CO.

NEW YORK, 150 Nassau Street. PHILADELPHIA, The Bourse.

Subscription Price One Dollar a year in advance to any Post Office in the United States and Mexico or United States possessions.

To Canada One Dollar and Fifty Cents; to Other Countries Two Dollars a year. Single copies 10 cents.

Address all letters and make all checks and money orders payable to Technical Publishing Co., 355 Dearborn Street, Chicago, Ill. Notify us at once of any change of address giving the old and the new address so that your paper may always reach you promptly.

Any advertiser is invited to examine our paid subscription lists and Post Office mailing receipts at any time.

Entered as second class matter May 1, 1908, at the Post Office at Chicago, Illinois, under the Act of March 3, 1879.

Circulation of this issue, 17,000

CONTENTS

Security Bank Bldg. Power House, Sioux City, Ia. Illustrated 401
Types of Turbine Wheels and Installations. By Frank Koester. Illustrated 404
Diagonal Riveted Joints. By Norman S. Campbell. Illustrated 406
Points for the Gas Engine Plant. By John Meyerott..... 408
A Compact Lighting Outfit. Illustrated..... 409
Heat Conversion in the Gas Engine..... 410
Igniter Circuits 411
Operation of a Producer Gas Pumping Station. By James R. Fitzpatrick. Illustrated..... 412
Gas Power for Interurban Railway Service. Illustrated. 414
Gasoline Engine Driving a Combined Sawmill and Brick and Tile Factory. Illustrated..... 416
Producer Gas Plant in an Ice Cream Factory. Illustrated 417
An Operating Test on a Gas-Electric Power Plant. Illustrated 418
London Letter. By W. A. Tookey..... 420
Hunting for Steam Losses. By E. G. Tilden. Illustrated 421
A Practical Talk on Engine Bearings. By A. E. Palmer. 423
Care of Commutators. By T. E. Campbell..... 424
A Big Water Power Plant. Illustrated..... 425
Rust Prevention 427
Editorial—Progress in Gas Engines. Celebration. Turbine or Reciprocating Engine. Briquetting Coal..... 428
Distilling Water for Artificial Ice. By S. J. Hogan. Illustrated 430
Questions for Marine Engineer's License..... 431
Letters from Engineers—Chlorine and Boiler Explosions. Explosion Beneath Grates. Draining a Heater Main. Steam Radiator Connections. Banking Boiler Fires. Diagram Study. Operating a Force Feed Oiler. 4-Valve Engine Diagrams. Air Pump and Heater Arrangement. Loose Piston in Corliss Engine; Broken Capscrew in Piston of Corliss Engine. Purifying Condensed Exhaust Steam. Water Columns. Illustrated.. 432
Questions and Answers—Boiler Problems..... 437
A Destructive Boiler Explosion. Illustrated..... 438
A Growing Plant. Illustrated..... 439
Characteristics of Good Packing..... 439
A Hurry-Up Job with a Portable Milling Machine. Illustrated 440
The Copper Combination Exhaust Head. Illustrated.... 440
Big Elevator Pumps. Illustrated..... 441
A New Feed Water Grease Extractor. 442
Twenty-Third Annual Convention, A. O. S. E. Illustrated 443
New York Engineers at Syracuse..... 447
Pennsylvania Engineers' Convention. Illustrated..... 449
New Jersey State Convention. Illustrated..... 451
N. A. S. E. Convention..... 452
News Notes 452
Book Review 452
Catalog Notes 454
Trade Notes 457

PROGRESS IN GAS ENGINES

One of the most complete reports on the present state of the gas engine as used in the power plant is that of the committee on gas engines of the National Electric Light Association. This will be taken up at some length in a later issue, but the chief points which attract attention are the expression by men who have been used to dealing with steam plants that the gas engine is now a reliable and successful power generator and that, while the gas producer has heretofore been rather behind the gas engine in design and development, progress has now been made so that for the better grades of fuel the producer is as reliable as the boiler.

Further, the producer is able to do things which the boiler cannot, in the way of using poor fuel, and the lignites of Texas and the Western and Northwestern states will soon be classed as available power plant fuels. The producers are not able to do everything that might be desired as yet in the handling of these lower grade materials, but improvements are being made and success has been sufficient to warrant confidence in the future.

For the handling of bituminous coals the double zone producer is noted as the most promising type. The difficulty in handling bituminous coals has been the getting of tarry products into the gas, which would, of course, clog up the gas engine valves and ports. The double zone producer tends to convert these tarry products into gas which is available for the production of power.

In the engine itself sufficient progress has been made so that the chief details are coming to be standardized. For instance, packing of pistons has been done by all kinds of devices in different makes of engines. Now a fair degree of uniformity is established with the cast-iron ring as the means, used in greater or less numbers, according to the experience of the designer of a particular engine.

In support of the reliability are instanced plants that operate day and night without stopping, even for a month at a time, giving a performance as steady and satisfactory as any prime mover. The attention of the committee was turned to the details of operation rather than to the fundamental matter of reliability and the necessity for the same intelligent care that is given to a steam plant is emphasized, and the need of looking after proper ignition, proper lubrication and proper cooling. It goes without saying that the fuel must be supplied at the proper time.

There has been no question in the minds of those directly interested in the gas engine that it is firmly established in the power plant field; the endorsement of this position by an association which strives to look impartially to the best interests of the power plant is final testimony. Just why the committee did not make public considerable data that it had acquired in regard to the performance of gas engine plants is not known, and that this information was not made avail-

able is certainly unfortunate, as it would shed a good deal of light on the much discussed question of the comparative economy of gas engine and steam engine plants, which seems to be the only point to be decided now in fixing the status of the gas engine in the power plant industries.

CELEBRATION

Just now, and fittingly, there is much discussion about our crazy habit of blowing some hundreds of promising young men and boys into eternity every July 4. It is worth while asking, "What is a celebration, and why?"

If we think a bit, a celebration or a holiday is established either as a jubilee—a time of rejoicing—or as a memorial. Which is the Glorious 4th? It is too long a time since we as a nation came of age to keep much of the spirit of jubilation, although that was undoubtedly the moving spirit a hundred years ago. The day has become one of commemoration of the founders of our republic and their great deed. Is it fitting to pay tribute to their memory by spoiling as many citizens and destroying as much property as Fate will permit?

The signers of the Declaration of Independence based their act on the right of every man to "life, liberty and the pursuit of happiness." Should the day which they made famous be spent by anyone in destroying life, or taking chances of destroying it, or in limiting the liberty and making less the happiness of others.

The present newspaper campaign is directed mostly against the small boy and his unbridled misuse of explosives. This is the most flagrant evil of the 4th. But why not set him a good example by avoiding harmful excess in every form and re-forming the spirit of the day so that it shall be given to increasing life, and to liberal additions to the happiness of all. And meantime why not get back to a public celebration which really commemorates the birth of this nation and gives to us and our children a deeper realization of the duties as well as the blessings of a citizen of the United States?

TURBINE OR RECIPROCATING ENGINE

This topic has seemingly been worn threadbare by much discussion, but new evidence is periodically introduced. Just now the point at issue is what shall marine practice of the future adopt, raised by comparative runs of the scout boats Chester, Salem and Birmingham, the 2 first named being turbine boats and the third having reciprocating engines. 16,000 hp. engines are in each boat, the displacement being 3,750 tons. In the Chester are Parsons turbines and in the Salem, the Curtis type is used. Four screws are used in the Chester; 2 in each of the others. At 10 and at 15 knots the fuel showing seems largely in favor of the reciprocating outfit. On the full speed test, the Chester, as was to be expected from its screw equipment, came in ahead, but a steam pipe accident on the Birmingham put that boat out of commission so that no conclusions can be drawn in spite of the fact that the daily papers headline the "doom of the reciprocating type." For any definite comparison we must wait until a test is completed, the outcome of which does not rest on a piece of defective piping construction.

BRIQUETTING COAL

Experiments on the use of run-of-mine and briqueted coal on locomotives and a torpedo boat have been made by the Geological Survey, the substance of the results as given by Prof. W. F. M. Goss, of the University of Illinois, being as follows:

Briquets made on the government machines have withstood exposure to weather and suffered little deterioration; briquets used in place of natural coal seem to have increased the efficiency of the boilers tested; smoke was no more dense with briquets than with coal and in most cases was less; with briquets an even fire may be more easily maintained over the whole area of the grate than with coal; in shipment to the plant, coal was exposed to the weather 30 days and showed but little change.

In all cases water-gas pitch was used as the binding material, costing at the briqueting plant 0.45 cent a pound. Five per cent of the weight of coal was needed of binding material in order to make perfect briquets, the cost of the binder in a ton being, therefore, 45 cents. Including all charges, the cost of briqueting was estimated at about $1 a ton, adding this amount to the cost of the run-of-mine coal.

Samples of square and round briquets placed on the roof of the testing plant showed after 4 mo. and 3 mo. of exposure no change whatever from their original condition. The briquets were little affected by handling, being loaded at St. Louis in open gondola cars and shipped to Altoona, Pa., where they were unloaded by hand and stacked. After a third handling, in taking them to the firing platform of the locomotive, but few were broken, and the amount of dust was negligible.

Results showed that the evaporation per pound of fuel is greater for briqueted coal than for natural coal, that the boiler capacity is considerably increased, that cinders and sparks are about the same in number but do not carry out so much heat, that the percentage of binder in the briquets has little influence on the amount of coke made, or on the evaporative efficiency. The expense of briqueting is greater than the gain in value of evaporative efficiency from briqueting.

Practically the same results were obtained with briquets made from Arkansas semi-anthracite, 2 qualities of Indian Territory slack, Missouri slack, Indiana Brazil block coal, coke breeze, and Pennsylvania coal

---

SIXTY-FIVE PER CENT is good average efficiency for the ordinary boiler and setting.

DISTILLING WATER FOR ARTIFICIAL ICE

APPARTUS FOR TREATING CONDENSED STEAM

BY S. J. HOGAN

THE importance of an effective apparatus for distilling the water which is generally used for the manufacture of artificial ice cannot be casually overlooked, as the distilled water eventually is what governs the quality and purity of the ice when frozen. In almost every can ice factory you will find the reboiler, forecooler, filters and such other auxiliaries as are required in the distillation of the sweet water as it is usually termed by the engineer. It is important that each one of those auxiliaries be arranged so as to get the best results possible.

The operating engineer's greatest worry in an ice plant in which ice is made on the can system is the purifying of the water that is used for ice making. During the operation of distillation and purification of the sweet water it is boiled in the reboiler and passes through the forecooler and filters to the storage tank.

Water, as a general rule, contains carbonic acid, and as the water leaves the boiler in the form of steam, the acid passes off as a gas, and when the exhaust steam is condensed, the acid having an affinity for iron, forms what is known as oxide of iron, which is insoluble and is held in suspension by the water the same as earthy matter or other material, and can be removed readily in a good clean filter.

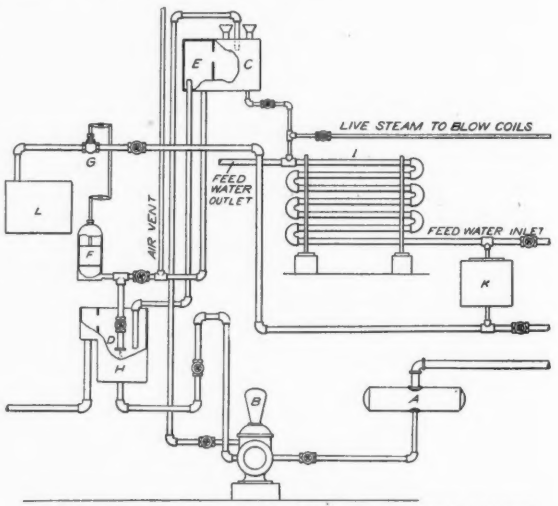
Organic matter, which is ever present in the water, passes from the boiler with the steam, and is reabsorbed when the steam is condensed, and the duties of the reboiler are to expel all the volatile matter, including the organic matter of the cylinder oil. The mineral particles of the cylinder oil are removed by skimming and filtering.

When the operating engineer is familiar with all the causes which go toward making poor ice, it should be possible for him to locate any trouble that may arise and remedy it. In the manufacture of artificial ice for commercial purposes it is imperative that it be free from discoloration and bad taste. To accomplish this, many obstacles are to be overcome, such as dirty boilers, steam condensers, cooling coils and the reboiler with its many appliances.

Water is a poor conductor of heat, and one part of a reboiler may be boiling while other parts are comparatively cool. When our plant was first started we had a great deal of trouble with bad tasting ice, and the core was so bad as to be almost unfit for use. We were obliged to make many changes in the original installation before we got any satisfactory results. The accompanying sketch shows the arrangement of the apparatus we have successfully operated for 6 or 7 yr. and have little or no trouble in making good pure ice; our capacity is about 250 tons in 24 hr.

The Plant

The exhaust steam enters the surface condenser, A, and when condensed the water flows from the condenser to the pump, B, which is placed below the condenser and is pumped into the reboiler, C, which is set on the roof of the building. The reboiler is made of galvanized iron with a cover on it; 2 open ventilators are on top of the reboiler to allow the foul gases to escape. A live steam coil is placed near the bottom and the water as it enters comes in contact with it, which causes the water to boil and carry the impurities toward the surface; the air and gases are carried out through the ventilator.



ARRANGEMENT OF APPARATUS FOR PURIFYING WATER

Attached to the reboiler is a compartment, E, for skimming the oil that rises to the surface of the water.

The reboiler is skimmed automatically by an old-time device, every 20 min. or half hour, according to the amount of water distilled. The device used to regulate the skimming of the reboiler works as follows: The plunger and cylinder, E, which operates the lever valve, G, is placed far enough below the reboiler to get a head of water sufficient to raise the plunger in the cylinder. As the plunger raises, due to the pressure under it, the lever valve opens and allows the distilled water to flow out of the reboiler..

The length of time that the lever valve is open can be regulated by placing a cap, D, on the outlet pipe to the tank, H, which is used to catch the water and oil that is skimmed from the reboiler.

A small hole, about ⅛ in., is bored in the cap, and when all the water has passed out of the pipe under the plunger through the hole the plunger drops

back to its original position and closes the lever valve; the reboiler will then fill up again. From the reboiler the sweet water drops down to the floor below and passes through the cooler, I.

The water that cools the sweet water is used as feed water to the boilers; in this manner we utilize the heat which otherwise would go to waste. After the sweet water passes through the cooler it enters the deodorizer or charcoal filter, K, for the extraction of any impurities from the distilled water. This forms the last step in the process of distillation and filtration and the water now enters the cold storage tank, L, from which it is fed by a hose to the cans as required.

The outlet from this tank is at the bottom and we had considerable trouble with the ice pullers to keep them from emptying the storage tank; when the tank became empty the pipe got partly filled with air, the sweet water absorbed it and the ice would be a milky white. The chief used to give the operating force a heart to heart talk every once in a while about the white ice, and he finally had the repair man put in a goose-neck with a nipple down to about 6 in. from the bottom of the tank; the ice pullers could not empty the tank after that and all our trouble ceased.

QUESTIONS FOR MARINE ENGINEER'S LICENSE

1. Can you determine the exact lead of a valve by an indicator card?

2. About what is the temperature of steam at 180 lb. gage?

3. What are the principal causes of the deterioration of boilers? Name 3 causes. Where does deterioration first commence?

4. With a cylindrical boiler shell 12 ft. in diameter, material, steel, tensile strength 60,000 lb., 15/16 in. thick, the flat surfaces or heads to be braced in proportion, what pressure would be allowed by the U. S. inspectors? One-sixth of the tensile strength is allowed for safety.

5. With a boiler 10 ft. long, 10 in. of water in the glass, when the ship is on even keel, but when listed over to port 15 deg., how many inches of water is now in the glass, on the starboard end of the boiler, the boiler being set athwartship?

6. With a crank shaft 15 in. in diameter, eccentric 5 in. throw, and moved on the shaft ⅛ in. from correct position the engine on either dead center, what distance would it move the valve in the steam chest?

7. Suppose you were burning pea coal and 2 or 3 bars fell down, or burned out, and you had no spare parts, what would you do to keep the fire going?

8. Suppose one of the tubes in the boiler gave out, and you had no patent tube stopper, or cap, what would you do?

9. An engine having a 42-in. stroke, and valve having 10-in. travel, with ⅛-in. lead, and 2-in. lap, how far will the steam follow the piston?

10. Steam at 60-lb. gage, clearance 5 per cent, what should be the cutoff to have the terminal pressure down to atmosphere?

11. Four boilers have 3 furnaces each, 3 by 5 ft., allowing 42 cu. ft. to the ton, how much coal will be required for a voyage of 2 days, rate of consumption given?

12. Engine cutting off at 0.5 stroke, what is the pressure at 0.75 stroke?

13. How would you set a spring loaded safety valve?

14. What is the capacity in tons of a tank containing fresh water, 18 ft. 3 in. long, and the cross section, which is semi-circular, 16 ft. 6 in. diameter?

15. With a corrugated furnace of the Morrison or Fox type, mean diameter 40 in., thickness 0.5 in., using a constant of 14,000, what pressure of steam would be allowable?

16. What would be the pitch of a 12 ft. propeller where a piece of pitch was 3 ft. and a piece of thread was 5 ft.?

17. The steam ports of an engine are 2.5 by 20 in., the valve has a steam lap 1.5 in. and a travel of 7 in., what area of port is open to steam?

18. Why use piston valves on high-pressure and D valves on low-pressure cylinders?

19. How do you regulate the density of water in boilers? Name the instruments used, and describe their construction.

20. If you evaporate 8 lb. of salt water, how much salt remains?

21. What precautions would you take if running a jet condenser in a sea-way; going alongside dock; what should be the maximum density carried, and how take saturations?

(A prize of $5 will be given for the best set of answers to the above questions submitted to Practical Engineer by any one of its subscribers interested, before August 15.—Editor.)

EXPERIMENTS AT THE UNIVERSITY of Illinois Engineering Experiment Station on the action of coal in gas producers show that for the production of a high percentage of carbon monoxide, which is the chief fuel constituent of producer gas, the fuel bed should have a temperature of 2,400 deg. F. or over. Increasing the depth of the fuel bed, increases the percentage of carbon monoxide, at first rapidly, then more and more slowly.

To give minimum carbon monoxide in a boiler furnace,—hence, maximum efficiency, the fuel bed should be thin. Increasing the velocity of the gas tends to cut down the proportion of carbon monoxide.

WHY HOT WATER PIPES freeze sooner than cold is explained by the fact that the air, which is a poor conductor of heat, is driven out by heating the water so that the water in the hot water supply pipes freezes more readily than water which has not been heated.

LETTERS FROM ENGINEERS

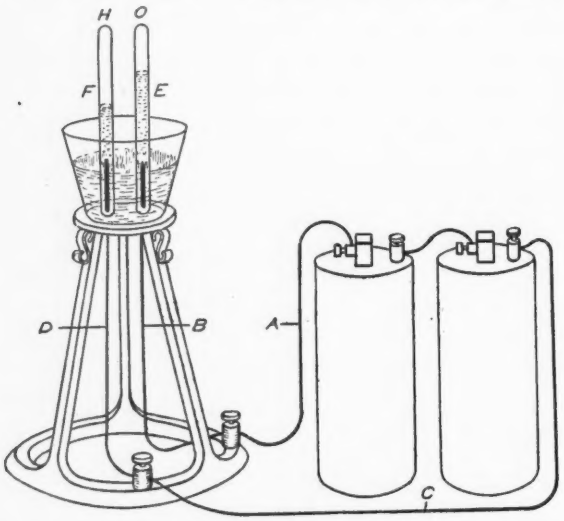
Send us descriptions of ways of doing new things, and new ways of doing old things. Rough pencil sketches and letters are all right; we will fix them up for the printer. All accepted contributions will be paid for when published.

Chlorine and Boiler Explosions

In the Practical Engineer, issue of March 1, 1909, J. M. has an interesting article on the above subject, but he might have gone a little further into chemistry and given us some more good food for thought along this line.

Now, J. M. is correct in his theory that it is almost impossible to unite chlorine and hydrogen in the dark, and that they will unite readily when exposed to bright sunlight, but this same union is not necessarily attended with violent explosions, at least not under certain conditions.

As long as this is kept in the dark, there will be



METHOD OF DECOMPOSING WATER

no combination of the 2 gases, they simply remaining mixed, or in ordinary daylight the conditions will usually remain the same, but before you expose this jar to the bright rays of the sun, you had best enclose it in a strong wire screen, for something is surely going to happen, and this is just what did happen in J. M.'s case.

But this condition of affairs could hardly ever be brought about in a steam boiler, for should any chlorine ever enter the boiler at all it would be by nature next to impossible to have been formed by any combination except a mixture of common salt, manganese dioxide and sulphuric acid exposed to heat, and after coming in contact with the feed-water, even though the gage glass may be exposed to bright sunlight, it would take at least several days for any change to occur, and the same water is rarely ever in the boiler that length of time. Even should there be any union of the 2 gases it would in all probability be by chlorine taking hydrogen from the water, forming hydrochloric acid and leaving oxygen, which would result in no explosion. Again, should any explosion ever take place in a boiler from this source, it would be due more likely to the internal temperature of the gases, due to pressure, than the sunlight on the gage glass, otherwise a dead boiler with say a gage or so of water, but not under pressure, would be just as likely to explode as a boiler in service, and I believe there is no case on record in which a dead boiler was known to explode.

Water is composed of 2 gaseous elements, hydrogen and oxygen, two volumes of the former uniting with one of the latter, or by weight, two parts of the former with sixteen of the latter.

Now, these 2 gases can be separated by any one of several chemical methods, but I will confine myself to decomposition by the electric current.

A chemical compound, water in this case, to be decomposed by the electric current is called the "electrolyte"; the constituent parts into which it is to be decomposed are called "ions"; and the act or process of decomposition is called "electrolysis." In electrolyzing water the hydrogen collects at the negative electrode, which is called the "cathode," so this ion is called a "cation," and is electropositive; the oxygen will in turn collect on the positive electrode, or the "anode"; this ion is termed an "anion," and is electronegative. Let me illustrate.

By referring to the figure you will note that the wires A and B are connected to the positive pole of the battery and the anode in the vessel of water, and the wires C and D are connected to the negative pole of the battery and the cathode in the vessel. Add a little sulphuric acid to the water to increase conductivity. Now fill the 2 receiving tubes with acidulated water and invert them over the electrodes. By closing the circuit of the battery you will note bubbles of oxygen, or anions, forming in the anode E, and bubbles of hydrogen, or cations, collecting in the cathode F. You will note that there is about twice as much hydrogen in the cathode as there is oxygen in the anode, hence the formula of water, H_2O.

Now such processes as the above are constantly taking place in nature—in the soil, water and in fact everywhere. Water is being formed and decomposed continually wherever it exists. These minute electric currents are gradually eating their way into all things. They are the most common enemy, not only of wood,

iron and steel, but of the precious metals as well. They are everywhere at work in the earth, like so many millions of little germs, invisible though powerful, silent yet never tiring in their ravages upon and destruction to the works of man. Daily we can see the signs they have left on the steel and iron framework of buildings, bridges, etc., and thousands of feet of underground piping and conduits are being destroyed annually by these little stray currents, flitting hither and thither in the soil. Then, is it not reasonable to suppose that they also find their way into many boilers, eating away and pitting the sheets, tubes, braces, etc.? And then, even before we realize that these little electric germs are round and about and among us, we record another case of that "mysterious boiler explosion," with its attendant disaster and toll of human lives. What, then, shall we do?

J. L. Bradshaw.

Explosion Beneath Grates

I noticed in the May issue an article in regard to unskilled firemen and license law for them by W. W. The following occurred at a plant here a short time ago which had but recently installed a fan blower and blast grates: A new fireman had been employed and had fired all 1 forenoon without raking down the fire. The foreman tended the boilers while the fireman was at dinner and had started to clean the fire, as he noticed there was a poor draft on account of the openings in the grates being stopped up with sawdust, the fan running meanwhile.

As soon as the fire had been sufficiently thinned to lessen the pressure on the grate openings and to allow part of the gas that had accumulated between the fan and the grates to escape and become ignited, the remaining gas confined in the air passage became heated and exploded, throwing flames and burning fuel through the furnace door for a distance of 10 ft., severely burning the foreman about the hands and face and setting his clothing on fire, which was extinguished with difficulty.

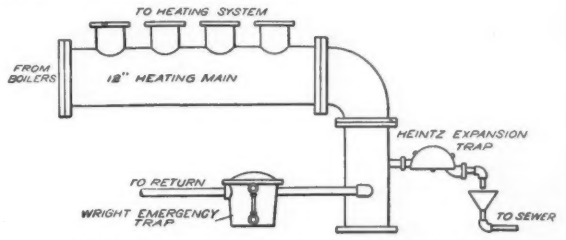
Which is the best investment, a skilled workman or an unskilled one plus such accidents as this?

L. R. S.

Draining a Heating Main

The steam for the heating system of a large building is supplied by a boiler plant through a 12-in. main to the center of distribution, a distance of about 300 ft., the total grade in this distance being 10 ft. The main terminated in a drip pocket, drained by a bucket trap which handled the ordinary condensation of the main but was unable to dispose of the considerable quantity of water which occasionally flooded the line, due to priming of the boilers or other reasons, and which caused pounding and serious vibration of the main. Furthermore, when the boilers were banked in mild weather, condensation would accumulate which the trap, not being under pressure, could not remove.

To remedy these defects in the system a Wright Emergency trap displaced the bucket trap and was connected to discharge into the heating return. This trap is provided with 3 valves operated by the same float and set so that 1 valve will remove the condensation under ordinary conditions, but should it become excessive the other valves will operate to give an opening equal to the pipe connection to the trap.



CONNECTIONS FOR DRAINING HEATER MAINS

As the trap discharged to the heating return, which is above the steam main, it also became inoperative when the pressure was down and this condition was met by connecting a Heintz expansion trap just above the connection to the Emergency trap so that, when the main was in service, the water line in the drip pocket would be low enough to have the steam in contact with the expansion trap, keeping it closed, but when the fires were banked and the condensation accumulated and cooled it sufficiently to cause its valve to open it would drain the main until steam raised it again and the other trap resumed its duties.

With the former arrangement, several serious accidents occurred, but since the new trap was installed they have removed condensation under all conditions and no further trouble has been experienced.

Lewis C. Reynolds.

Steam Radiator Connections

In regard to the 2 methods of connecting radiators, from my experience, I would say neither, that is, for steam, which he appears to be considering. Figure 1 would be suitable for the single pipe system for hot water, Fig. 2 for the double pipe by connecting the pipe marked "vent pipe" to the supply.

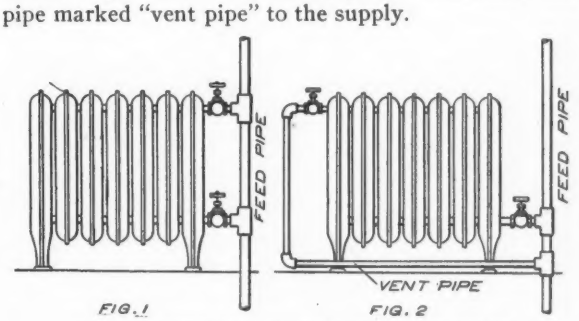


FIG. 1. VENT PIPE CONNECTED ABOVE INLET
FIG. 2. VENT PIPE CONNECTED BELOW INLET

Figure 1 might be used for steam by admitting steam at the top, but I think the circulation would be better, at least more positive, by removing the pipe

between the connections to the radiator and plugging the tees or replacing them with ells. It is advisable, whether using steam or hot water, to carry the fluid in the direction of drop in temperature; of course, it may be necessary, at times, to bring both pipes up through the floor, but the mains should tend to fall with the flow.

For steam I consider the sketch, Fig. 3, to show

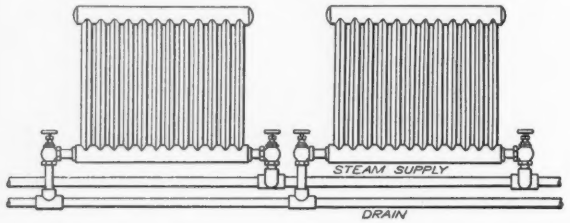


FIG. 3. CORRECT METHOD OF CONNECTING STEAM RADIATORS

the best way to connect radiators, the amount of radiating surface governing the size of pipes.

As an aid to proper operation of a steam heating system I would also suggest that care be taken to drain all pipes properly, all rising pipes being provided with a bleeder at the change in direction. A cheap valve is good enough to regulate the amount of opening. Of course a trap is best but is rather expensive to install in many places and, as the people who pay the bills have to be considered, a valve is satisfactory if properly managed. Harry H. Yates.

Banking Boiler Fires

In reading the May issue of the Practical Engineer I noticed that B. W. Howell gives a way of banking fires which he thinks is good and no doubt is. But my way of doing the same trick is as follows: One-half hour before closing down I put 4 scoops of fine coal back against the bridge wall in 1 corner, then a couple or so over my fire.

At the next firing I put 4 more scoops of fine coal on the bank and just enough to hold steam on front. Then at about 5 min. before closing down, I put a couple more scoops of fine coal on the bank. I then close ash pit doors and damper and open the flue doors about half way. Saturday night I always put about 3 scoops of ash over the bank, which I think helps to hold the bank till Monday morning.

In banking this way, one has clean grates on building his fire in the morning. I have used the above for 10 yr. and think it good. Lindon A. Cole.

Diagram Study

This diagram would be improved and the efficiency of the engine increased by diminishing the inside lap, or the lap of the exhaust valves, thereby securing an earlier release and later compression.

The right hand card appears to have too early admittance; to remedy this, increase the lap of this steam valve. To find the mean effective pressure on either card divide the card into 10 equal spaces on the volume line and at the center of each space erect an ordinate, then measure each ordinate in inches between forward and back pressure lines. These measurements must be accurate. Divide the sum of

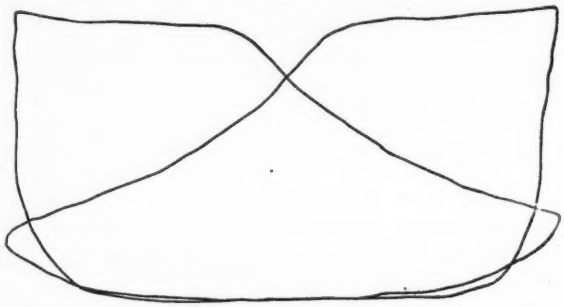


DIAGRAM FROM A 24 BY 48-IN. CORLISS ENGINE

the 10 ordinates by 10, and multiply by the number of the spring. After the mean effective pressure is found, the horsepower is found by the formula:

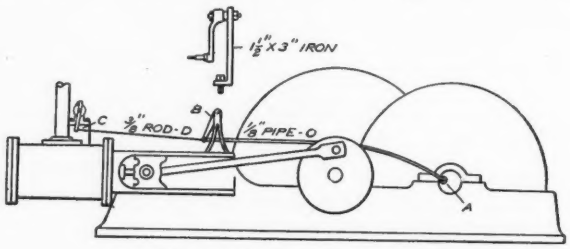
$$\text{Hp.} = \frac{\text{P L A N}}{3300}$$, in which P = mean effective pressure, L = length of stroke in feet, A = area of piston in square inches, N = number of strokes per minute.

I should judge that the compression curve should not rise to over 0.3 the initial pressure.

The initial pressure on the diagram is about 93.75 lb. and in this case steam at 120 lb. was used, this shows a big loss of pressure somewhere between the boiler and the engine. S.

Operating a Force Feed Oiler

I enclose a sketch of a device which I applied to a double 18 by 24-in. engine for operating a 4-qt. ratchet oil pump. These engines hoist a load of about 100 tons and are backed down by the gravitation of the load. Their movement is too rapid to take the



METHOD OF CONNECTING OIL PUMP

motion for the pump from the engines direct, therefore it is taken from the end of the intermediate shaft A.

Connection B shows the device for overcoming the vibration and shortening of 0.5 in. pipe O, as well as taking the extra weight off the delicate connections on the pump. It consists of a piece of 0.5 by 3 in. iron

14 in. high, forked and turned at right angles on the bottom, secured to the engine bed by 2 5/8-in. tap bolts. A rocker arm 7 in. long is suspended from its top, at the lower end of which is a pin with 5/8 in. and 3/8 in. bearings, respectively, carrying the pipe O and a 3/8 in. rod D to the pump connection C. It does the work perfectly. E. E. Sarr.

4-Valve Engine Diagrams

I am enclosing 2 indicator diagrams taken from a 19 by 24-in., 4-valve, shaft governor engine, operating at 150 r. p. m. with back pressure of 100 lb. taken with a 50 lb. spring. I would like to hear from some of the readers of Practical Engineer what they think of them. J. W. Varden.

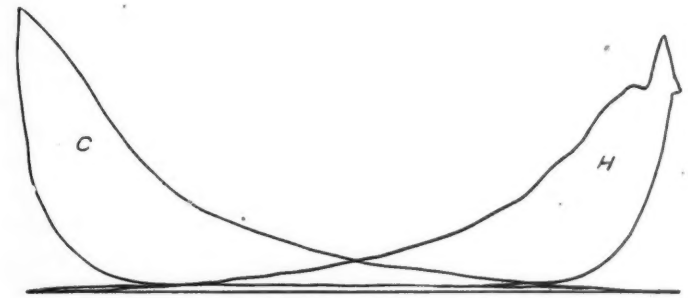


FIG. 1

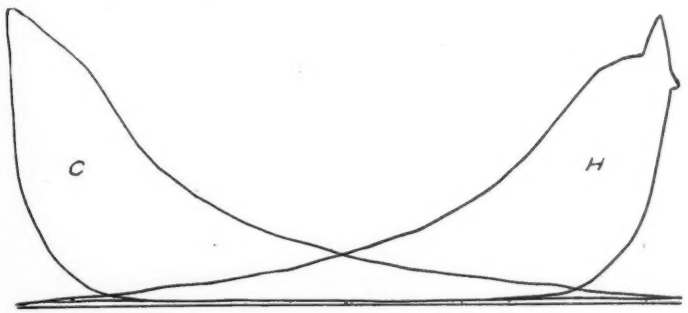


FIG. 2

DIAGRAMS FROM 4-VALVE ENGINE

Air Pump and Heater Arrangement

The sketch shows discharge from air pump into heater. The water from the condenser is discharged through this pipe into the feed-water heater. I would like the readers' ideas on the reason for this layout and its advantages. Notice that the pipe is enlarged about midway on the column.

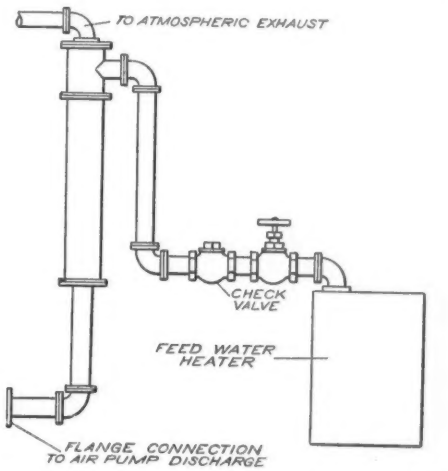
W. P. H.

Loose Piston in Corliss Engine; Broken Capscrew in Piston of Corliss Engine

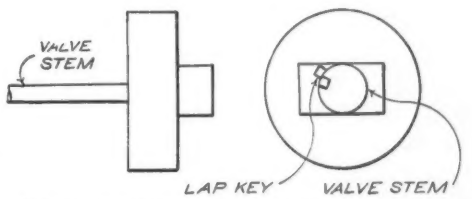
At one time a company installed a 750-hp. Corliss engine, rated to run at 75 r. p. m., in its power house. The engine company sent an erecting engineer to install the engine, and after the engine had been started a few days, but before the erecting man left the power house a knock was heard in the engine which seemed to jar it all over, and the longer the engine ran the worse the knock became. The engine was examined externally for lost motion at every place outside, but the knock could not be located.

Then the engine was shut down and the cylinder head taken off, which showed the piston head loose on the rod.

The nuts on the end of the rod were screwed up as tightly as they could be and the engine started again. It ran satisfactorily for several months, when a slight knock began to be heard again, which increased as time went on.



PIPE CONNECTION FROM AIR PUMP TO HEATER



DAMAGED VALVE STEM AND SPLIT LAP KEY

Again the engine was thoroughly examined, as above, with like results and like remedy, and again the engine was started.

This was repeated for 5 or 6 times, when it was found that the lock nuts on the end of the rod were not getting loose, but that the piston head was shoving onto the rod and thus leaving a space between the nuts and the head of the piston. A tin bushing was placed on the rod under the head, which was used until the engine could be shut down several weeks for repairs, when a new piston was made and the old rod turned to fit the new piston head, and since then there has been no more trouble of that kind.

The piston of a 28 by 48 in. simple Corliss engine was made up of a hub and spider, which fitted on the piston rod, and a bull ring in which were located the expansion rings. On each side of the spider and bull

ring were follower plates. The follower plate on the head-end side of the piston being held in place by 8 capscrews or bolts.

One night the engineer heard a change of sound of the engine, as if one valve had failed to hook up, for a time or 2, and the engine kept on running. One of these cap bolts had broken off and, as the head of the bolt was quite large, it failed to go through the port in exhaust valve at first, but hung, and as the valve closed the bolt caught between the valve and valve seat, which bent and twisted the valve stem. The stem was so badly twisted that when the steam valve was open the exhaust valve was open also, thus letting live steam direct into the exhaust pipe, which made it shake and quiver quite violently.

As there was not time to spare to make another stem the old one was taken out and straightened, and a lap key was made to take the place of one which was split when the cap bolt caught. This lap key did not give the engine quite enough compression on this end so the short rod that runs from the wrist plate to the valve crank was lengthened enough to make up the difference and the engine was started. An indicator was used to adjust the length of rod.

O. L. Harper.

Purifying Condensed Exhaust Steam

I notice that Wm. Shenton states that there is such a thing as a perfect oil separator. By a "perfect" separator, I infer Mr. Shenton means 100 per cent elimination.

While not attempting in any way to condemn the use of oil separators or discredit their usefulness, I should consider them only as a partial protection. With open heaters, for instance, whether the separator be out on the line or a part of the heater, oil is usually found floating on the water surface in the reservoir. Open heaters are provided with a "skimmer" for this reason, for, if the water gets low in the reservoir of an open heater, the surface oil may enter the feed line in masses.

There can be no question of the benefits of using the most efficient oil separator obtainable and preheating the feed water in an open heater, but neither of these devices completely removes the oil.

The percentage of oil that gets into the boiler is material only in the matter of time, for as the Hartford Steam Boiler Insurance and Inspection Co. said 20 yr. ago, "Where oil or grease used for lubricants comes in contact with the steam and is allowed to pass into the boiler, trouble is a dead sure thing." That statement is as true today as it was then. If the oil comes in small quantities, the trouble may take longer to show up, but it will appear soon or later.

One method of prevention of this trouble has been the employment of closed heaters to prevent the exhaust steam from coming into contact with the feed water. If open heaters are used it is best to give the feed water a thorough filtration at the last point in the feed line before the water enters the boiler.

One kind of filter now used quite generally in stationary plants contains a number of small linen-terry-covered cartridges through which feed water must pass before it can get into the boiler. The layers of cloth are separated so that the water is subjected to a double filtration. The oil and other suspended impurities are caught on the first layer, but any particles which may find their way through this are sure to be stopped by the second layer. In quite a number of instances where oil from open heaters had been a source of much annoyance, the trouble has been stopped immediately upon adding filters of this type. Cleaning the filters may be necessary anywhere from once a week to once a month, owing to the condition of the water, and as the whole cleaning operation can be completed in less than 10 min., and as the terry may be used over and over again, the cost of attendance and upkeep is practically nothing.

In view of this convenience and the effectiveness with which these filters have done their work, it would seem well worth while to take the final precaution of filtering.

M. A. E.

Water in Bottom of Can Ice

In reference to the cause for having water in the bottom of the ice cans as described by Mr. Double in the June issue I would say that, presuming the cans did not leak and the water was pure, the reason would be a difference of temperature of the brine in the top and bottom of the tank, and caused by either a reduced volume of anhydrous liquid passing the expansion valve, or that possibly, the compressor has recently been overhauled and draws the expanded gas more rapidly from the lower coils before abstracting its proportional number of heat units from the brine, thus creating the conditions that then existed. The writer's experience is, that had the cans been left in the bath until frozen solid, the bottom would have bulged and most likely sprung a leak.

It is a good plan to have 2 thermometers, one near the top and one near the bottom, or when only one is used have it at least half the depth of the bine, as it is far preferable to freeze from the bottom up than from the top down.

The suction and discharge pipes of the brine circulation pump should be perforated and extend nearly the entire width of the bath in order to make an equal distribution and circulation. The suction should be near the bottom with perforations turned up, and the discharge be a few inches below the surface with perforations turned down. Both pipes should be well protected from the ordinary atmosphere, and the circulation should be just enough to establish about an even temperature over the entire bath; any more is a loss of cold by radiation.

Wm. S. Luckenbach.

QUESTIONS AND ANSWERS

Our readers are invited to send in their troubles and problems; also to answer questions which are asked. All letters must have name and address of writer, which will not, however, be published. If answers are wanted by mail, send stamp for reply.

Boiler Problems

1. Why does not a glass water gage show the water level in a boiler?

2. How much more pressure would you add on a safety valve, if a pipe 20 ft. high, full of water, be placed on top of the valve?

3. What is the horsepower of an engine cylinder 10 by 12 in. running at 300 r. p. m. with a m. e. p. of 50 lb.?

4. What is the horsepower of a boiler 42 in. in diameter, 14 ft. long, containing 30 tubes 4.5 in. in diameter, the heating surface being the tubes and ½ the shell?

5. What is the stress on each bolt when 2 stay bolts are used 4 in. from center to center under a pressure of 120 lb.?

6. What is the use of a vapor pipe on the suction pipe of the pump?

7. What is the use of an inch pipe that is placed by the side of an exhaust pipe?

8. How would you clean the scale from the tubes of an injector?

9. How would you regulate the water supply to a boiler inlet with a steam pump? Also when using a power driven pump? P. A. McC.

A.—The water glass in a boiler should show, if it is working properly, the correct water level, except in a case where the dirt or impurities in the water cause foaming. In such cases the bubbles and foam in the glass will change the apparent water level.

2. A column of water 20 ft. high would give a pressure on the top of the valve of 8.7 lb. to a square inch and would add that much to the pressure required to lift the valve.

3. To find the horsepower of your engine, multiply the mean effective pressure by the length of the stroke in feet and by the area of the piston in square inches, and by the number of revolutions a minute. Divide the final result by 33,000. For your case we have $50\times1\times78.5\times300$ divided by 33,000, which equals 35.64 horsepower for 1 end of the cylinder or twice that which equals 71.28 hp. for the 2 ends.

4. The rating of the boiler is usually based on 12 sq. ft. of heating surface to the horsepower. In your problem ½ the shell and all the tube surface is to be reckoned as heating surface. A boiler 42 in. in diameter is 3.5 ft., circumference will be 11 ft. and the outside surface will be 11 by 14, equals 154 sq. ft. Since half the shell is to be reckoned, the heating surface on the shell would be 77 sq. ft. The tubes are 4.5 in. in diameter. From the table of sizes of boiler tubes we find that it takes a length of 0.849 ft. to give 1 sq. ft. of heating surface. A tube 14 ft. long would then have 14 divided by 0.849, which equals 16.5 sq. ft. on each tube, and for 30 tubes it would have 30 times that or 495 sq. ft. This added to the 77 ft. of the shell gives 572 sq. ft. and dividing this by 12 gives 47.67 hp.

5. If stay bolts are spaced 4 in. apart on centers, then each bolt has to carry an area, 4 by 4 in. equals 16 sq. in., and if there is 120 lb. pressure on a sq. in., the 16 sq. in. will give 1,920 lb. total that each bolt has to carry.

6. I presume that you mean by the vapor pipe on the suction of the pump the air chamber. This is put on simply to steady the flow of water to the pump. If a pump has a high lift or a long suction pipe the reversal of the piston at the end of the stroke tends to check the flow of the column of water in the suction pipe and is likely to produce water hammer and straining of the pipe. With an air chamber the cushion of air in this chamber takes up the shock and permits a steadier flow of the column of water.

7. The inch pipe which goes up alongside the exhaust pipe is a drip from the exhaust head to bring down the moisture taken out of the exhaust steam.

8. About the best way to clean the tubes of an injector is to take down the injector and soak it in a strong solution of soda ash. Sometimes a small drill can be run through the opening if it is badly clogged, but ordinarily the soaking out treatment will be about as rapid and much more satisfactory.

9. The water supply to the boiler when using a steam driven pump is regulated by regulation of the speed at which the pump runs. It is better to slow down the pump so that it feeds slowly and continuously rather than run it at full speed for a time and then shut it down. In other words, what is wanted is to feed in water to the boiler just as fast as it is turned into steam so that the water level in the boiler will be held constant. In the case of a power driven pump a bypass must be provided so that water not needed in the boiler can be allowed to flow back to the hot well. The amount of water pumped by a power driven pump which must run at constant speed is a fixed quantity and it is necessary to arrange the piping so that what is needed can be taken to the boiler and the rest sent back to the suction side of the pump.

BLESSED IS THE MAN who has found his work and then—gets busy.

A DESTRUCTIVE BOILER EXPLOSION

IN DOWAGIAC, MICH., on the afternoon of May 26, occurred a disaster which resulted in the complete destruction of the Geesey Bros. & Coble hoop factory. There was located in this factory a 60 hp. fire-tube boiler, which exploded with terrific violence, scattering boiler flues and broken pieces of the machinery of the factory promiscuously for a distance of 40 rods.

During the busy season of the year the factory employed about 35 men, but at the time of the explosion was about ready to close down for the season and only 8 men were in the building, 5 of whom were killed almost instantly, 2 severely injured and 1 escaped unhurt.

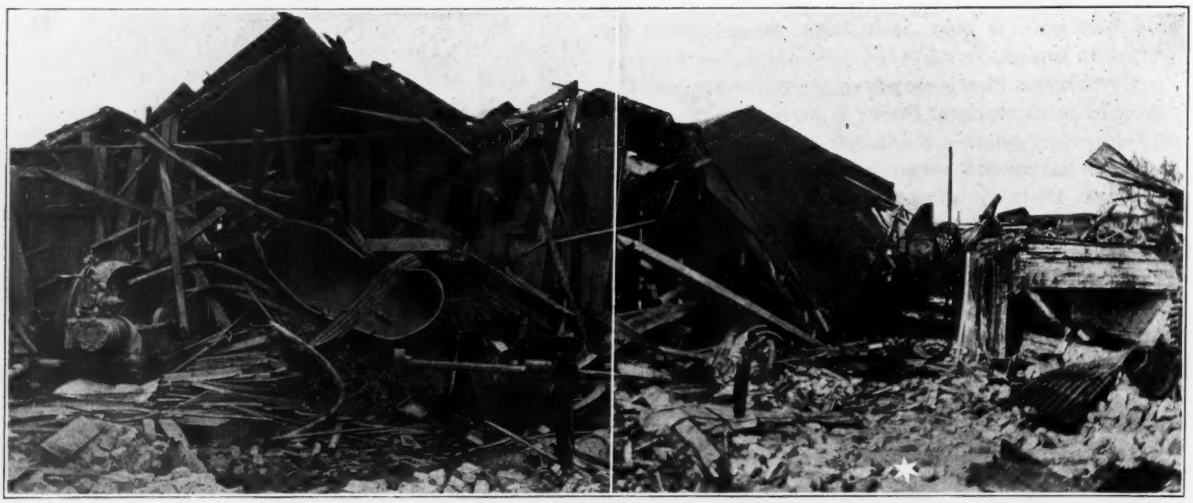


FIG. 1. VIEWS OF THE FACTORY AFTER THE EXPLOSION

The building was a 1-story frame structure with a tee-shaped plan, the boiler being located in the center of the main part of the building, as shown by the star in Fig. 1. The boiler furnished steam for a 35-hp. Peerless engine, which drove all the wood-cutting machinery of the plant.

When the explosion occurred, the engine had been running loaded and was being shut down to allow the men to put on a belt. There was a slight warning given to the men in the plant, but not sufficient time intervened for them to get away before the boiler was thrown up to the roof of the building, landing about 50 ft. to one side of the setting among the debris of the factory.

The boiler plate was flattened out by the force of the explosion, as is shown in Fig. 2, and the flues were scattered in every direction. The metal smoke-stack, which was 40 ft. high, was blown 150 ft., and the main part of the building, as well as the machinery in it, was completely demolished. The brick boiler setting was leveled to the floor, and it was only by the quick work of the fire department and the pouring rain that the ruins were not entirely destroyed by fire.

The boiler, which was 12 ft. long, contained 3-in. flues and was made of lap-riveted boiler plate, which was quite badly corroded, being from ¼ to 5/16 in. in thickness. Since the boiler was installed in this plant about 7 years ago, it had never been inspected or its steam gage tested by a competent inspector. The pressure normally carried on the boiler was 110 lb. and the safety valve was set to blow at 115 lb. The firing was done with the refuse of the factory.

The cause of the explosion is not fully understood, but it is believed that the sudden change from nearly full load to no load increased the pressure above the strength of the boiler and that the safety valve failed to operate. It is believed also that the steam gage was stopped up and failed to indicate the correct pressure. The boiler was torn from end to end in such a way as to indicate a flaw in a side-lap joint.

FIG. 2. BOILER PLATE SHOWING LONGITUDINAL TEAR

The regular engineer was away at the time of the accident and the engine was in charge of Estel Gamber, who had been a helper in the plant for some time. The only insurance carried by the company was upon its stock of hoops, as underwriters had for some time refused to insure the factory or the machinery it contained.

A GROWING PLANT

A recent mail brings to hand very pleasing evidence of the prosperity enjoyed by some of our good friends in Milwaukee.

It does not stretch our imagination a great deal to recall the time when the manufacture of the Richardson oil pump was begun. Starting, as have many of the prominent specialties in the steam engine field, with the ideas and backed by the enthusiasm of but 1 man, the first conception of an engineering article and the conviction that there existed a need for it, has led through various vicissitudes until there has been built up an organization for the manufacture of the article, to meet the demands of other engineers who are using and appreciate the value of the specialties being manufactured.

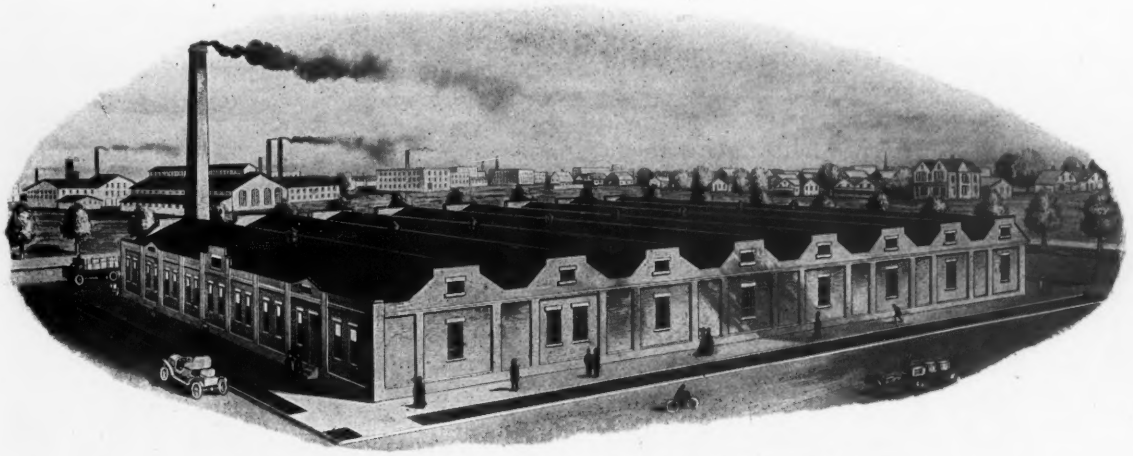
Beginning 8 yr. ago with the construction of an experimental pump, which, by the way, is still in service, successfully doing its duty, the manufacture of the Richardson pump was undertaken by a firm of novelty makers and machinists who built them in small quantities; the company maintaining only an office.

It was but a short time until this arrangement was found to be insufficient, and a shop was organized for the manufacture of the pumps, occupying a portion of a blacksmith and carriage building factory, and those who were in the organization at that time tell some interesting stories concerning the difficulties with which they had to struggle.

Another year or so finds the industry occupying half a building at one time used for an automobile factory, with ample space and better facilities. In less than a year the entire building was occupied for the manufacture of the pumps, spreading out the machinery and adding new machines to increase the facilities. This arrangement was found to meet demands for about 2 yr., at which time it was necessary to move the office into an adjacant residence, occupying the lower floor for office purposes and turning over to the purposes of the shop all the area of the old building.

It seems evident that those who have bought once came again; for the increase of business has demanded still further increase of facilities, and we are pleased to show evidence of it in the shape of a view of the new works now being built for the Sight Feed Oil Pump Co. at Milwaukee, Wis.

Old friends of the company and of Mr. Richardson, its president, and inventor of the oil pumps bearing his name, will find a hearty welcome in the new quarters, which will be occupied about Aug. 1.



NEW WORKS OF THE SIGHT FEED OIL PUMP CO., MILWAUKEE, WIS.

CHARACTERISTICS OF A GOOD PACKING

A large percentage of all engineers' troubles are due to packings used for one purpose or another. Scarcely any 2 engineers will have had exactly the same experience, so varied are the results obtained from different kinds and different brands of packings. Most engineers endeavor to obtain a packing especially adapted to their requirements, so as to insure durability and freedom from packing troubles.

What most engineers desire is, a packing that will withstand indefinitely, high steam pressures and temperatures, and at the same time, be flexible and soft enough to be used on rough flanges and those which may be slightly out of parallel. In other words, that packing which would best meet all requirements would be one possessing the toughness and durability of metallic packing as well as the softness and pliability of rubber packings. Such a packing would be capable of being cut into any required shape and would be obtainable in various thicknesses, and when a joint is broken it could be removed intact, coated with a little graphite and used again.

It is claimed that Vanda packing possesses the desirable qualities just mentioned and that the characteristics of this packing approach very closely those of a readily workable metallic packing; that this packing is not made of rubber, or canvass, and that high

temperature has practically no effect upon it. To prove its heat resisting qualities some joints packed with Vanda packing have been put into a furnace where the intense heat quickly melted rubber and left Vanda as good as new, yet it can be put on any rough flange. The black packing of this make is adapted to be used under a pressure of 250 lb. or a temperature of from 800 to 1000 deg. and is equally good for use where there is low temperature.

Simply putting it on in a workmanlike manner, tightening the joints as much as possible, and letting it alone, is all the attention required as there is no necessity for following up joints that are located in hard-to-get-at places.

Thicknesses from 1-32 to 1-4 in. and in sheets 4.5 by 4.5 ft., or when especially desired in sheets 4.5 by 9 ft. can be supplied, also gaskets of any shape and size, upon receipt of dimensions. The packings may be obtained from the New York office of the Vanda Co., or in any large city at the distributing agents address.

A HURRY-UP JOB WITH A PORTABLE MILLING MACHINE

Herewith is illustrated one of the "quick aid to the suffering" operations performed by the Hartford Engine Works, of Hartford, Conn. It shows a special

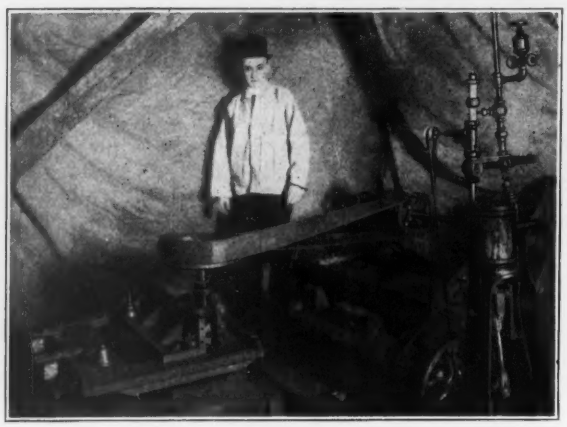


FIG. 1. SPECIAL MILLING TOOL DRESSING AN ANVIL BLOCK

milling tool in position milling off the top of a steam hammer anvil block at Collinsville. The top of this anvil block has taper holders and one of these strips was broken off, as shown at A in Fig. 2, so that the

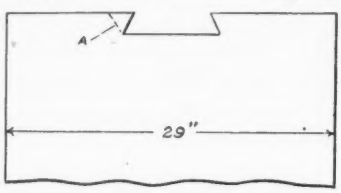


FIG. 2. TOP OF STEAM HAMMER ANVIL BLOCK

block had to be milled off in place, about 3 in. of the metal being removed and a new slot milled in.

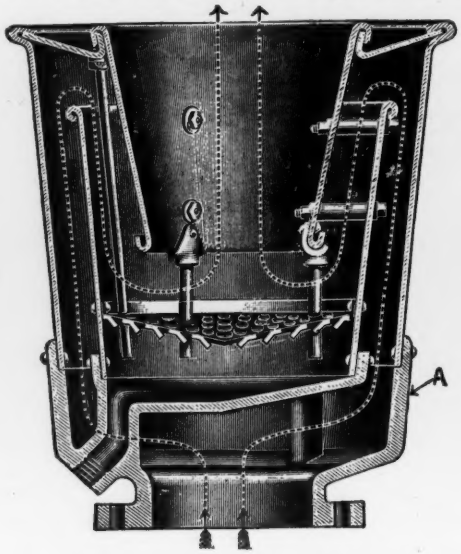
This block weighed over 7 tons and had under it and around it about 20 tons of bars, all of which were nicely rusted together into a solid mass. This made the removal of the block practically an impossibility, and dressing off in place was the only solution of the difficulty.

The milling machine was made fast in position and set to work at the job, as shown in Fig. 1, the drive being from a vertical engine set up on a temporary foundation. The job was entirely satisfactory and is a typical example of the kind of repair work in place, of which the Hartford Engine Works makes a specialty.

THE COPPER COMBINATION EXHAUST HEAD

Designed to be made entirely of copper and cast iron, the Neverust Exhaust Head is a substitute for cast-iron heads. Larger than the all cast heads yet lighter because of its thick copper sheet construction, its efficiency is increased and the durability not lessened.

Steam in passing through the head takes the course indicated by dotted lines. The base of head is extended upward at A so that the steam current will never cut it away at this point as might be the case if



THE NEVERUST EXHAUST HEAD

of thinner metal; at the top the steam has expanded so there is not this tendency.

The cone, which takes the blow from the steam, and the base of the head are of one piece made as a substantial casting. The top of head is arranged so that any water settling upon it drains to the lowest point and through a pipe to the water chamber and from there out of the head; in times of storm this flushes this part of head, and since the passage to the drain is very large, no cleaning is necessary.

This head is sold by Franklin Williams, of 41 Cortlandt St., New York City.

BIG ELEVATOR PUMPS

Recently the American Steam Pump Co. of Battle Creek, Mich., has completed shipment of 3 large American compound outside center packed plunger pumps to be installed in the new Belnord Apartments, 86th, 87th streets, Broadway and Amsterdam avenue, New York City, on hydraulic elevator service. These pumps are 24 and 38 by 19 by 24 in., and each has a rated capacity of 1,400 gal. per minute at a piston speed of 100 ft. against a working pressure of 180 lb., although designed to withstand a water pressure of 250 lb. with safety. The steam pressure for operating will be 100 lb. at the throttle. The pumps weigh 48,000 lb. each.

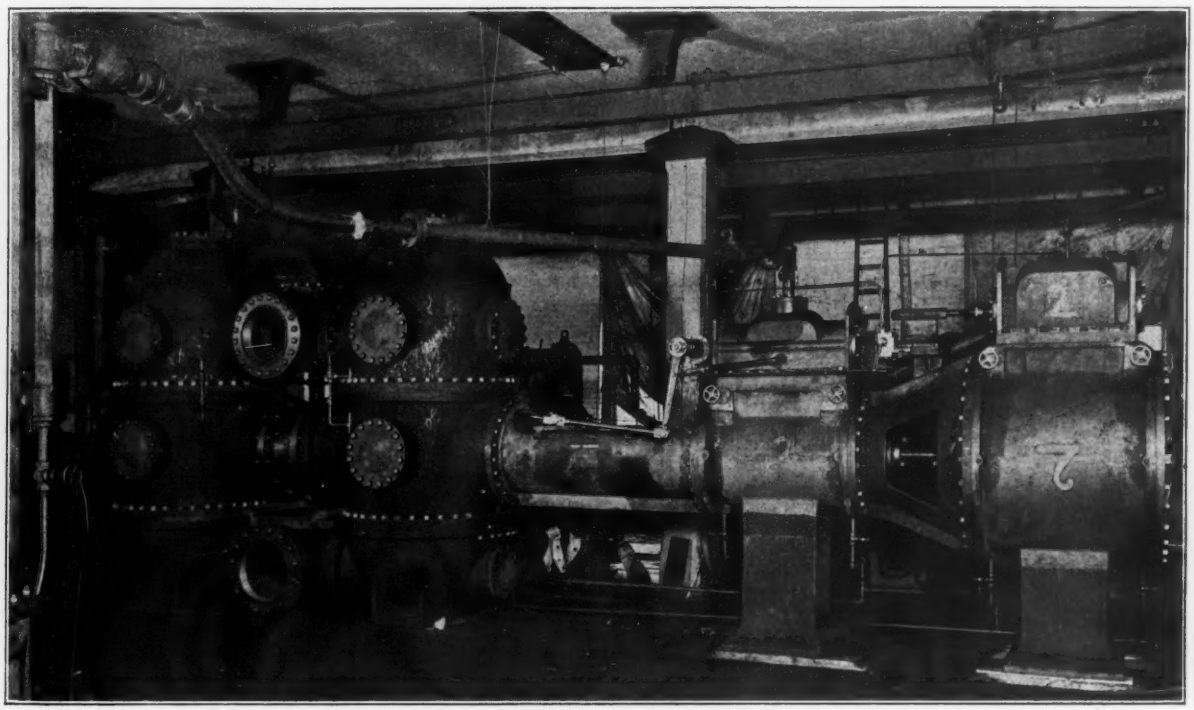
The service on which the pumps will be used is the operation of 15 standard plunger hydraulic elevators, 6 of these to be passenger, 5 having a run of 136 ft. 6 in. and 1 a run of 164 ft. 6 in.; 8 freight elevators having a run of 164 ft. 6 in. and one sidewalk lift of 22 ft. 6 in. run. The service is designed to operate on schedule of a round trip every 2 min. and will allow 4 passenger elevators and 4 freight elevators to leave their lowest landing simultaneously.

The steam ends of the pump are of regular American construction, using cylindrical steam distribution valves governed by a cylindrical auxiliary valve. All valve chests are carefully ground and fitted with ground bushings, and both high and low-pressure valves are fitted with double sets of expansion rings ground to a fit on both sides and circumference. The low-pressure valve is operated by the high-pressure, through a bronze rod connection. The auxiliary valve is also of the piston type and fitted to its chest as is the valve.

Operation of the valve mechanism is as follows: The auxiliary valve is rotated by means of a lever arm and rod attached to the pump crosshead. At a predetermined point in the stroke of the pump, subports in the auxiliary valve open and admit steam, which shifts the auxiliary longitudinally, thus opening the ports for the steam which trips the main valves. The point of termination of the mechanical throw of the auxiliary is regulated by adjusting screws. This point of adjustment determines the position of the pump stroke at which the main valve is thrown and the direction of the piston travel reversed.

The pumps are designed to operate successfully and without shock or jar on 25 per cent overload, and water passages and valve areas are of ample capacity to allow for this high speed. As will be noted from the illustration, which is from a photograph taken at the company's plant, the water ends are of the barrel pattern, having all cylindrical sections, this construction being necessary because of the heavy duty demanded. When installed, the steam ends will be completely lagged and necessary accessories, such as mechanically operated lubricator, pressure governor, etc., are included.

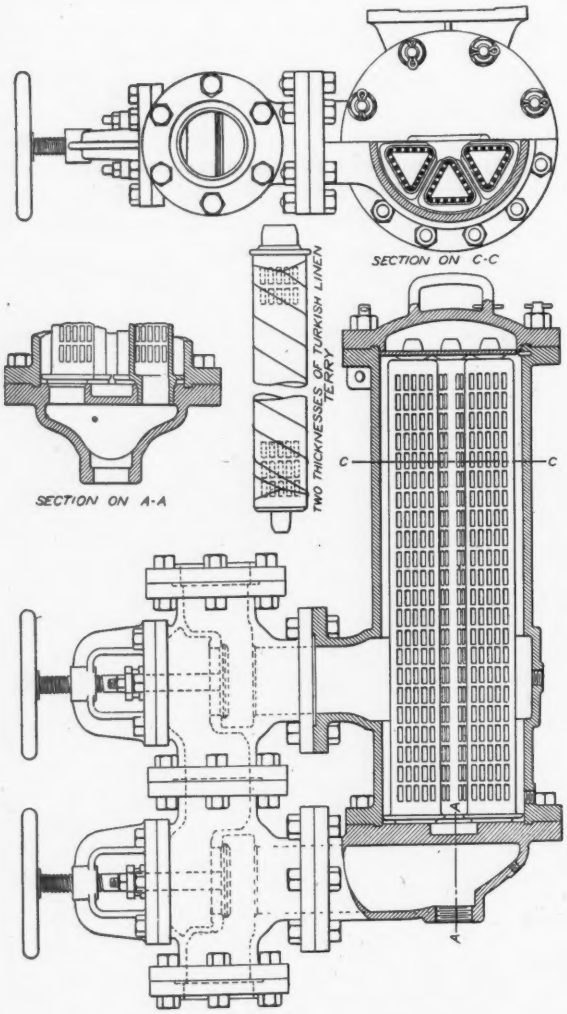
Large hand hole plates give easy access to the water valves and all stuffing boxes are extra deep and very accessible. The installation of these pumps will undoubtedly add to the prestige which the American



AMERICAN TANDEM COMPOUND PUMPS FOR ELEVATOR SERVICE ON HIGH PRESSURE

Steam Pump Co. has gained in New York City, which has been brought about by the remarkably low steam consumption shown by simplex pumps of its manufacture, their low maintenance cost and reliability in action.

The company is well equipped to handle these large pumps, having a thoroughly modern shop, machine tools and overhead track system throughout the plant, allowing economical handling of parts which are used in steam and power pumping machinery of every description which it manufactures.



SECTIONAL VIEWS OF AMERICAN FEED WATER GREASE EXTRACTOR AND DETAIL OF FILTER CARTRIDGE

AN INCREASE FROM 3.5 MILLION GALLONS of the oil of coal tar, or creosote, as it is popularly known, imported into the city of New York in 1904, to an amount estimated to be almost twenty-five million gallons last year, is one of the indications pointing to the progress of the nation-wide movement for the conservation of forest resources, as this is largely used for wood preservation.

A NEW FEED WATER GREASE EXTRACTOR

In this device, which has many points of advantage, the water enters at A, and with the valve disks as shown dotted, flows into the main chamber where it passes through a coating of linen terry wrapped over the cartridges. It then passes down through the center openings in the cartridges into the base and out at B.

When the valves are screwed shut, a bypass is opened back of the disks so that the water flows by the extractor unhindered. In this condition, the swing bolts which hold the cover to the main chamber may be loosened, swung back and the cover and cartridge removed for cleaning, or to be replaced by an extra set.

These cartridges are triangular in form so that a large surface may be put into a small space. The area of openings in the cartridges is 48 times that of the inlet to the extractor. Two thicknesses of Turkish linen terry are placed about each cartridge and fastened in place by wire. The cartridges are then placed in the main chamber, seating in the base and being held at the top by a plate and spring washers.

Pressure gages are attached to the main chamber and to the base to tell the difference in pressure caused by coating the filter cloth with grease.

Steam connection, ¼-in., is made to the base so that the cartridge may be cleaned by blowing in steam, avoiding as frequent changing as would otherwise be necessary.

From what has been said and an examination of the illustration, it will be evident that the shell is small and compact; that the cartridges are easily recovered and replaced, occupy but little space and will work in any position; that the extractor is especially well adapted to marine service on account of these facts while they are advantageous in stationary plants as well.

Connection can be made in any position and to operating valves or in the pipe line.

Getting the grease out of feed water is an important problem and this apparatus which is made by the American Steam Gauge & Valve Mfg. Co., of Boston, Mass., is an important aid to its solution.

PLANS FOR A NEW POWER PLANT for W. T. Stevens & Sons Co., North Andover, Mass., have been completed, to consist of turbine-generator, boiler and pump room, with coal pocket in the rear. The walls are to be of brick. In the 25 by 50 ft. turbine room will be installed a 360-kw. Westinghouse turbine generator with 2 exciters and a motor driven Le Blanc condenser. The boiler room will be 40 by 50 ft. and equipped with two 72-in. Bigelow tubular boilers with forced draft. Space is provided for a duplicate boiler installation. The pump room is to contain both the boiler feed pump and a 1,000-gal. fire pump. The stack is to be of brick 150 ft. high with a 6-ft. flue. Plans were drawn by Chas. T. Main of Boston.

TWENTY THIRD ANNUAL CONVENTION, A. O. S. E.
READING, PA., JUNE 7 TO 11

THOSE convention committees were dandies and they worked,—hard and intelligently. So, of course, the convention was bound to be a success. Hiram M. Trout, chairman of the Reading convention committee and W. G. Le Compte, president of the Supply Men's Association are both veterans of many a convention campaign; and they were given royal assistance by their aids on their respective staffs. All concerned in the preparations have a right to feel proud, and justly earned the praises which were accorded on every side to their work.

Monday

Began with an opening session of delegates in Rajah Temple, at which Mayor Rick welcomed the delegates and complimented the supply men on the handsome exhibit.

After response by Supreme Chief Engineer Frederick Markoe, who presented to the mayor a souvenir badge of the occasion, the council went into executive session which lasted through the morning and again assembled in the afternoon. At the afternoon session Chief Markoe was presented a solid gold badge by President Le Compte of the Supply Men's Association on behalf of that association.

The American Order of Steam Engineers is organized of white running engineers, 21 yrs. of age or over, who have really qualified as experts. It never interferes between employer and employe nor does it take up politics or religion, but its objects are: To promote a more thorough knowledge in its members of theoretical and practical steam engineering. To assist members to obtain employment. To help the sick, injured and distressed and bury the dead. To establish a Widows' and Orphans' Fund. To help members who shall become incapacitated from following the profession to obtain employment suited to their affliction. To do our utmost to extend the license law throughout the United States. To establish schools in which our members may study the highest branches of steam engineering.

After appointment of committees the meeting was adjourned until Tuesday.

In the evening the exhibit was formally opened and during the evening a concert was rendered in the hall by Keppleman's Orchestra.

Tuesday

This day was occupied with 2 sessions of delegates, and with the exhibits open morning, afternoon and evening. At the afternoon session, supreme officers were elected as follows:

Chief engineer, Frederick Markoe, Philadelphia; first assistant, John Best, Atlantic City; recording engineer, T. J. Armbruster, Philadelphia; corresponding engineer, W. S. Wetzler, Philadelphia; treasurer, T. J. Dunnoven, Philadelphia; senior master mechanic, W. J. Courtney, Columbia, Pa.; junior master mechanic, Walter Long, York; inside sentinel, Oscar Roth, Allentown; outside sentinel, W. J. Eccles, Philadelphia; chaplain, James Lightfoot, Philadelphia; trustee, D. B. Leidman, Reading.

These officers were installed by Senior Past Supreme Chief Franklin R. Moore, and Assistant Past Chief G. W. Richardson.

After lively discussion, an amendment to the constitution was adopted giving a more liberal policy with regard to benefits.

Some 400 persons sat down to the tables for the Tuesday evening banquet, and blessed their stars that they came. The ladies had spent the afternoon on a trip to Neversink Mountain, and were as ready for the waiting meal as were the delegates after an arduous day in meetings and the exhibitors after attending to the big crowd in the exhibit hall.

Although the courses came under unusual names, they were old reliable and acceptable friends. Some of the novelties were: French rolls, covered with magnesium asbestos molded; oyster cocktails, served in No. 4 compression grease cups; spring chicken, with connecting rods; new potatoes, governor balls; lettuce, made up in 600-deg. cylinder oil; refrigerated cream, flavored with extract from a hot pin; extra, indicating mackerel pot pie, with necessary cocks and valves.

For the overtime run, Hiram Trout acted as supreme boss toastmaster and kept his crew well in hand. The first on watch was Frederick Markoe of Philadelphia, speaking on the principles of the order; then Charles S. Leippe of Reading spoke for his council, and was followed by Judge Bland of Reading and by Past Chief N. R. Pierson of Baltimore.

Merriment ran high and was greatly assisted by the German band from Baltimore, the recitations of Claude Miller and Armour's talk.

Wednesday

Busy meetings morning and afternoon and an evening—in fact a night—of entertainment, made up a full day. Several changes in method of working were warmly discussed and disposed of, greater liberality in membership and traveling cards being adopted, and Philadelphia was chosen as the meeting place for 1910. The evening program, and the early morning aftermath were rendered by the "New York Bunch," with solos by Herbert Self of the Peerless Rubber Co., Frank Corbett of the Ashton Valve Co., Jack Armour of Power, and Billy Murray of Jenkins Bros. Bouquets of roses were presented during the evening by Chief Markoe to Chairman Trout of the convention committee and to the officers of the Supply Men's Association, President Le Compte of Jenkins Bros., Vice-President Charles Hopper of the Keystone Lubricating Co., and Director of Exhibits McConnaughy of Dearborn Drug and Chemical Works.

Of the "not on the program" parts was the entering march by the American Supply Band in "fezzes." It was "awful" but interesting; and Jack Tracy of Jenkins Bros., who was awful good. Everything was fine and "the Bunch" did itself proud at all points of the game.

Thursday

Closing sessions marked the closing day and to close all was an excursion over the gravity road to Mt. Penn, and a ball game, dance and supper at Waldheim park near Rosedale were scheduled but got drowned out. And Thursday night it was "away to home" and the engines throb once more, and Reading had a chance to go to bed that night. And all who had come and gone said "It was a dandy."

Exhibits and Exhibitors

Between 40 and 50 firms were represented, and the uniformity of signs, railing and drapery gave a most pleasing effect to the hall, as well as doing away with much drudgery and confusion.

On Tuesday the representatives held a meeting, at which, after introduction by President Le Compte, Wm. Just stated the objects of the association, point-

FIG. I. EXHIBITS AT THE READING CONVENTION

ing to the work accomplished at the present convention and bespeaking the aid of all manufacturers in the power plant line.

Mr. Le Compte told of the labor of love of the officials, asked the continued aid of the representatives and, in closing, presented Mr. Just with a solid gold badge.

At all entertainments supply men were on hand and active, but the only other business session was on Thursday morning, when election of officers and determination of policy for the coming year was in order.

Officers elected were: President, Charles Hopper of the Keystone Lubricating Co.; vice-president, N. S. Kenny of the Philip Carey Co.; secretary, Fred L. Jahn, of the Watson & McDaniel Co.; treasurer, John W. Armour of the Hill Publishing Co.

FIG. 2. EXHIBIT AT THE READING CONVENTION

Executive Committee Supreme Council, A. O. S. E.: George R. Richardson, Clifford P. Williams, Franklin R. Moore.

Director of Exhibits: John R. Livezey, Philadelphia.

Exhibit Committee: Charles Dickey, Cyrus Borgner Co., Philadelphia; T. D. Just, American Engineer & Pub. Co., Philadelphia; W. R. Smith, Southern Engineer, Atlanta, Ga.; L. H. Adams, Anchor Packing Co., Philadelphia; Capt. Doughty, Lords Boiler Compound Co., Philadelphia; Mr. Frank H. Waite, McLeod & Henry Co., Troy, N. Y.; Harry Hamstadt, Cancos Packing Co., Philadelphia; J. F. Boreland, France Packing Co., Tacony, Pa.; Charles Curren, O. F. Zurn Co., Philadelphia; Harry Crowder, Jr., Crandall Packing Co., New York, N. Y.; Frank Duemler, W. B. McVicker Co., Philadelphia; S. W. Anness, Practical Engineer, Philadelphia; John J. Buckley, Berry Engineering Co., Chester, Pa.; E. Colt Magens, H. Belfield Co., Philadelphia; C. H. Mosher, American Gauge & Valve Mfg. Co., Boston, Mass.; Hugh Edwards, Garlock Packing Co., Philadelphia; Edwin J. Rooksby, H. B. Underwood & Co., Philadelphia; Ellsworth A. Corbett, Corbett Supply Co., Trenton, N. J.; H. B. Ham, Scully Steel & Iron Co., New York, N. Y.; G. P. Wilson, Jr., Engineering Equipment Co., Philadelphia; W. S. Reichenback, W. M. Taylor & Co., Allentown, Pa.

The policy of uniform signs and spaces was commended, and arrangements made for a sort of information committee to gather for the use of associations material and information from manufacturers.

In the Booths

Where so much was and of so much excellence, even complete listing is out of the question. But at each stop some special feature caught the interest and of these a brief survey. On entering the door 2 large spaces attracted the visitor:

In the space of H. W. Johns-Manville Co. was an infinite variety. David T. Dickinson, manager of the Philadelphia branch, was in charge, and with him were Samuel Hildreth of N. Y., and F. B. Stein and George H. Syckelmorre of Phila. The company's exhibits ranged from J-M Asbestos Roofing, down through the plant to Portland Sectional Conduit for insulating underground steam and hot water pipes, including pipe coverings, packings and gaskets, fire extinguishers and electrical devices. Lighting the whole was a practical demonstration of the Linolite system for show case, window and desk lighting as described in the June issue of Practical Engineer.

W. B. McVicker Co., chemical engineers of N. Y., set "Bill the watchdog of the boiler room" on guard to look after visitors to its rest room. But no matter who ate the pretzels or how many, nor who came for the cigarette cases and blotters or for a quiet chat with McVicker, Bill Schatz or Duemler, Bill only winked the other eye and never made a move.

Up the aisle the Philip Carey Co. showed its pipe coverings and asbestos and magnesia specialties, with N. S. Kenny of the Baltimore house in charge, and beyond was an exhibit of motor switches, panel boards and motors by the Engineering Equipment Co. of Phila., looked after by J. P. Manypenny, G. P. Wilson, Jr., and D. A. Roberts.

Fred L. Jahn, although busy with executive committee work, found time to display the Watson & McDaniel steam specialties, the sectioned trap and pump governor being strong features.

And H. B. Underwood & Co., Phila., needed 2 spaces to show its interesting cylinder boring and crank pin turning machinery as actually operated when making engine repairs. E. C. Crawford, who has been 17 yr. on this line, and Edwin J. Rooksby, proved fully the value of the apparatus and the methods used, and demonstrated the advantages of a new design of Corliss engine dashpot.

American Steam Gauge and Valve Mfg. Co. of Boston, with its brass specialties, was across the aisle and had in the foreground and used a copy of Practical Engineer to prove that "You are entitled to the best"; then showed what the best was with a sectioned model of its American Special pop safety valve and outside spring indicator. C. H. Mosher of Boston and H. Brennen of N. Y. were at this booth.

Allentown Rolling Mills display of the Aldrich electric boiler feed pump was one of the notable heavy machinery exhibits; a triplex power pump motor driven by a silent chain drive, in charge of Joseph Holwick.

Cranetilt traps of the Crane Co. and Lippincott shaking grates of the Scranton Steam Pump Co. were shown by Wm. H. Taylor & Co. in a double section. Memo. books and Crane elephant paper weights came from there by grace of Messrs. H. L. and W. S. Reichenbach and W. S. Barker, and D. E. Rosser was present as special representative of the Scranton Co.

Fire Brick, special shapes for all cases and fire clay, special quality, were found in the space of Cyrus Borgner Co. of Phila. Carl A. Dickel explained the merits of standardized forms of brick for furnace construction and furnished penwipers to clean the pens after writing in orders.

CRANDALL PACKING CO. specialized in its exhibit on the lip hydraulic packing and you "asked the man" about it, said man being Harry M. Crowder, Jr., of N. Y.

OILS IN TUBES and oils in bottles arranged on a neat pyramid stand showed the products of O. F. Zurn Co., pencil souvenirs being given along with much information by G. W. Childs and Charles Curran.

QUAKER CITY GOODS are always unique and its exhibit was likewise due to the care and thought of Sales Manager A. K. Wilcox, who looked after it. He and Mr. Armstrong fixed up Valrolite Twist, Daniel's P. P. P. Ebonite sheet and hose into an ornamental display fit for a den in an engineers' club.

FRANCE METALLIC ROD PACKING and square and round coil packings were the features in the France Packing Co. exhibit. The pen and pencil combination was an attraction, also the metal watch fobs, but the exhibit was the main thing and for this the credit is due to Messrs. A. W. France, J. F. Borland and L. Dyer, who looked after it.

WHEN THINGS WERE GETTING HOT it was time to start up Wing's disc ventilating fan and while that cooled you off H. S. Whealer of New York or Joseph P. Kirkup of Philadelphia would show you all about Wing's Turbine Blower system of mechanical draft for your furnace; and furnish you a memorandum book to take notes about it too. Those fans certainly did run right.

CANCOS HAD SOMETHING new; a metal polish that shined things for keeps. That wasn't all, for the good old Black Squadron packings were on hand in all forms and Harry Harmstad was there to tell you about them.

LORD'S COMPOUND. The name Geo. W. Lord tells the story. For years it has been above a prominent booth at every convention of engineers; and always a group of genial representatives are on hand to tell about it and prove the goods. The barrel charms, the "charming" art booklet and the genial welcome were all there. The veteran salesman, Capt. John Doughty, was chief of the staff, with Chas. W. Phillips, consulting engineer for the company, and B. L. Lord as lieutenants.

WILLIAMS VALVES, AUSTIN SEPARATORS AND WRIGHT STEAM TRAPS formed the main display in the booth devoted to the steam specialties handled by McArdle & Cooney of Philadelphia. Pratt & Cady goods and a line of pipe fittings were also shown. The Wright Emergency Trap with triple valve was of particular interest. Chas. P. Sauville and Geo. Donjes were the salesmen.

SAMPLES OF ITS COAL occupied the Hutchinson-McCandlish Coal Co.'s booth, and H. B. Cornog and Arthur Rick gave out the blotters and baseball scorers.

TWENTY DOLLAR GOLD (?) PIECES were free as air at the booth where Belfield brass goods were displayed. Of course they drew a crowd. R. L. Murray, president of the H. Belfield Co., John R. Goehring, superintendent, and E. C. Magens did the honors.

TAURIL? YES, THAT'S THE NAME, and you didn't get by the Anchor Packing Co. without knowing the Tauril means packing. C. M. Barnes of Allentown, D. J. P. Murray of Baltimore and W. R. Haggart of Philadelphia proved it to you.

Then you crossed the hall and came to:

BERRY ENGINEERING CO., with Carl A. Corin of Reading and John J. Buckley of Chester to tell how the Berry Regulation holds always constant the water line with pure water from the Berry Purifier, while the Berry Damper Regulator keeps the draft right to take care of the evaporation.

THAT REILLY HEATER, with its copper coils and good, generous door to get at them, stood right out plain. It made a striking exhibit in the booth of the Griscom-Spencer Co. and its advantages spoke for themselves, although R. J. Pabodie was active, too, in telling about the heater and the Coe shaking grate.

PEERLESS. There are several "peerless leaders"; Rainbow, Red Core, Honest John, all Peerless goods; all well shown, of course—for Herbert Self was there to show them and Bert can talk as well as he can sing and that's saying a big lot. Those "red core" briarwood pipes were heartily appreciated. H. Krauth of Philadelphia did his full share at the exhibit.

AND THERE WAS THAT KEYSTONE BANNER backing up the fine display of the Keystone Grease cups, cans and caps. The caps were all over everywhere and the lunch boxes in everybody's pocket. Hopper had his hands full with the whole show, but he found time to meet his old friends, which meant everybody, at the booth. W. F. Buzby was at the booth; he says Keystone is good always and everywhere; externally, internally and eternally.

DICK FOLEY AND N. B. O. are always together. They Never Blow Out, but Dick always blows in at a convention to take care of the Home interests. Warren Jones was there, too, to help.

DEARBORN HADN'T ANY SHOW; but then "Pinky" Spear is a whole show in himself and McConnaugh owned the whole hall, so what did it matter if Mac had kindly given up all but space for a sign. Everybody knows Dearborn Goods anyway and anybody who missed Spear and Mac was found by Paul T. Payne or P. G. Jones, so everybody got acquainted with Dearborn and Dearborn's frog.

CERTAY PACKINGS and the Vacuum tube cleaner; these were they, and E. A. Corbett of the Corbett Supply Co. exhibited them.

JENKINS BROS. They make about everything in brass specialties and a full line was on exhibition; also those '96 packings. One of the interesting things was the Graber Automatic gage glass, which closes if the glass breaks. W. G. LeCompte, Frank Martin, J. E. McHugh, S. Laird and "Billy" Murray constituted the efficient, effective, ever in evidence "volunteers of '96."

IF ANYBODY LOST his sand, he could use Steel Mixture and he could get it of Frank V. Tuthill, who represented McLeod & Henry Co. If he lost any time Frank would supply a good fob to hitch by and if his feet got tangled the Steel Mixture two-foot rule would straighten out for him. Besides the model boiler setting the arrangement of mailing card books was most effective.

WHEN YOU "SEE CALIPERS" you have been at Garlocks. The No. 900 is covered with them and that was "the thing" in the booth, although the Pitt metallic came a close second in the interest created. H. N. Winner. H. W. Gulager, Hugh Edwards and C. I. Hebbard helped supply the smokes and the "smoke clippers."

SCULLY STEEL & IRON CO. always gets attention to its exhibit, for the blowoff valve problem is a hard one, and the Everlasting appeals to the engineers who see it. The Ruggles flue cleaner has such a clean cutting, sensible way of getting the dirt off tubes that it wins, too. H. B. Ham was the man on the job.

TECHNICAL PAPERS were well represented. For Practical Engineer, Arthur L. Rice, managing editor, was present, and S. W. Anness of the Philadelphia office in the Bourse Bldg. For Power, C. W. Dibble, F. R. Low, J. W. Armour, W. R. Van Kleeck and S. Kirlin. For American Journal, T. D. Just, J. F. MacIndoe and H. Sonneborn, and for Southern Engineer, J. W. Smith and S. B. Koons.

NEW YORK ENGINEERS AT SYRACUSE

June 11 and 12

BY THE courtesy of the superintendent of the Onondaga County Court House and by the hard work of the chief engineer of the plant for that building, Harry Bache, quarters for exhibitors and delegates were ready and such quarters as are seldom provided for a state convention; a fine assembly room with all appointments, a space on the floor below beautifully decorated with flags and streamers and with tables already provided, waiting for the exhibits to be displayed. And the exhibit was notably the best ever shown at a New York state convention, both as to number of exhibitors and the extent of apparatus displayed.

Opening Session

The first meeting of the convention was on Friday forenoon, Mr. Bache, chairman of the local committee, calling the delegates to order and introducing Mayor Forbes, who extended the usual welcome. State President J. C. Roberts of Kingston responded, alluding to the convention of Knight Templars to be held the following week and saying that the organization of the engineers was for the same purpose—advancement and education of the members.

Past President Jos. F. Carney was not able to be present, but Herbert Stone, past national president and Eastern manager of the Dearborn Drug & Chemical Works, spoke briefly, mentioning the fact that men in other callings which pertain to the safety of souls and bodies were licensed, including the doctor, the lawyer and the plumber, but engineers were not, and that for the good of the state and the safety of the public, examination and license should be adopted.

"In Massachusetts we realize the danger from incompetent engineers, and we guard against this by license. Chancellor Cunningham and Jim Day, the friend of Teddy, ought to know this, and anyway, me and Eliot, who ran Harvard university for years, understood it." Mr. Stone was for years chief engineer of Harvard.

Adjournment was then taken until Saturday, the afternoon being spent on an outing at Long Branch, where luncheon was served. In the evening a theater party was in order.

Saturday

Saturday morning was devoted to the routine of convention, hearing reports of committees, taking up action in regard to the state license law, and after luncheon to the election and installation of officers. A considerable difference of opinion existed as to what the best course should be in regard to license law, some favoring a heavy assessment in order to raise a considerable amount of money, others figuring that the appropriation should be made sufficient for ordinary routine work and any additional funds needed raised by subscription afterward.

It was finally decided that the license committee should hereafter be called the legislative committee, that the request of the educational committee for funds should be granted so far as the treasury would permit and that an appropriation of $125 for the use of the legislative committee should be made, and the president authorized to issue an emergency call for money to carry on the license work whenever he found it necessary to do so. A bill for a license law is to be prepared by the committee and to be sent to Albany the 1st of January.

Election of officers resulted in the choice of G. H. Wood, of Rochester, as president; C. Schubacker, of Brooklyn, as vice-president; E. E. Pruyn, Rochester, re-elected as secretary; Winfred L. Graham, of Buffalo No. 16, as treasurer; Harry Bache, Syracuse, as conductor; J. N. Gregory, of Buffalo, as doorkeeper, and Stewart Warner, Syracuse, as chaplain.

In accepting the election as chaplain, Mr. Warner spoke of the custom of acknowledging at each meeting of other associations our indebtedness to the Ruling Power of the universe and advocated that this should be made a part of the regular ritual in the meetings of engineers' associations, both national, state and local, and proposed that this matter should be brought before the next national convention, a proposition which it is to be hoped will be carried out.

Appropriate resolutions were adopted on the death of Brothers Nick Kelley, of Buffalo; Ira Watts, of Seattle, and James McDonald, of Syracuse.

In regard to a future place of meeting, the secretary of the Syracuse Chamber of Commerce invited the association to come again. As the delegates from Albany were tentative in regard to the advisability of holding it in Albany next year, the convention finally adopted the resolution that Albany should be considered as the next meeting place unless it was found inadvisable to go there, in which case Buffalo should be designated.

Saturday evening a goodly company gathered at the Hub and disposed of unlimited quantities of edibles. Then came an entertainment in which Herbert Self of the Peerless Rubber Co., Billy Murray of Jenkins Bros., and Jack Armour participated. Afterward, Harry Bache, acting as toastmaster, introduced the speakers, J. E. Reagan, the first president of the state association; Prof. John E. Sweet of the Straight Line Engine Works; J. C. Roberts, past state president; Herbert E. Stone, past national president, and E. E. Pruyn, state secretary, who presented to Past President Roberts a stick pin and cuff buttons mounted with diamonds.

Exhibits

Of course, in the exhibit hall there were the old familiar faces in many of the booths, and there were a goodly number of new exhibitors, who brought their devices for the first time to the attention of an engineers' association. On going down the stairs the first booth to be encountered was that of the

GARLOCK PACKING CO., with the usual full line of Garlock goods. F. J. Highmoor, of Rochester, was present as representative and distributed to the delegates a miniature pack of playing cards which was much appreciated.

THE UNDER-FEED STOKER CO. OF AMERICA was represented by Wm. T. Johnson, of Buffalo, who had a full line of catalogs showing the construction of the stoker and its installation under different styles of boilers. Catalogs of the Bartlett water softener were also found in this booth. Mr. Johnson reported a recent sale of 17 stokers in Buffalo, to the Standard Oil Co. and Parkhill & Hart Steam Laundry.

B. M. BULKLEY represented Greene, Tweed & Co. and had on display a line of the Palmetto packings in the twists, squares, and rounds, and also the Favorite Reversible Ratchet Wrench with all attachments. A new style of packing to which Mr. Bulkley called attention was the Manhattan self-lubricating for hydraulic pumps and elevators.

IN THE PRACTICAL ENGINEER BOOTH, which had been tastefully arranged by John P. Smith, Jr., the Syracuse

representative, were found samples of Practical Engineer, of the premiums offered with a 2 years' subscription at $1.50, and circulars describing the various special offers which are now in force. Mr. Smith's Syracuse address is 613 Catharine Street.

EDWARD JOY & Co., of Syracuse, made a fine display of electrical specialties, including switches, Tungsten lamps and reflectors, fixtures, etc., and besides this showed a full line of valves and brass specialties made by the Lunkenheimer Co., of Cincinnati, the special feature being a big iron model of a globe valve which is to be used as a permanent sign by the company at its store. The Huhn Metallic Packing and Vanda Sheet Packing were also exhibited. A novelty in the Lunkenheimer goods was the H W crosshead pin oiler. The firm was represented by G. M. Ramsden.

THE DEARBORN DRUG & CHEMICAL WORKS had a large and varied exhibit in the person of Herbert Stone, who was, as usual, in a good many places at once. When he was not playing with the rolly-polies he was jumping frogs, and when he was not distributing epigrams at the booth he was up in the meeting helping Joseph N. Gregory, the other Dearborn representative, out with speech-making.

THE DIRECT SEPARATOR CO. displayed its Standard and Extra Heavy Flanged Fittings, which were especially attractive and impressive as being of good design and with the metal well distributed. There were the Powers steam traps, made by this company, the Sweet vertical and horizontal steam traps, the Neverrust Exhaust Head which is sold by Franklin Williams of New York City, and illustrations of the big line of steam fittings which has been specially made by the Direct Separator Co. for the Solvay Process Co., some of these being 10 ft. inside diameter. Representing the company at the exhibit were Prof. John E. Sweet, founder of the company, C. K. Thomas, secretary, and H. G. Smith.

JAS. H. BLESSING, president of the Albany Steam Trap Co., brought to the attention of engineers a number of things which some of them had never heard of before, including the Albany gravitating return trap, the return bucket trap, check valves with renewable seats and disks, globe valves, gate valves and separators.

FOR THE MCLEOD & HENRY CO., our old friend, John H. Foote, manager of the New York office, was there and showed you how to measure the furnace for the fire box blocks of Steel Mixture, which engineers ought to install, so John says, in every furnace. The mailing card books are certainly a great device for the convenience of engineers in placing orders.

GEO. S. HERRICK, of Syracuse, exhibited his patent shaking grate which is arranged so that it will give larger or smaller area for the passage of air, according to the position in which it is set. The teeth on the grate bars are arranged with one convex and the next concave, so as to break up the clinker. The grate was shown in a full sized model and on the opposite side of the setting was THE NORTH HOT AIR BLAST SMOKE CONSUMER, made by Stephen H. North, of Syracuse, which forces a blast of air in behind the bridge wall in such direction as to mix thoroughly with the hot gases and at the same time aid the draft through the boiler. Mr. Herrick represented the grate and Mr. North was in charge of his own exhibit of the smoke consumer.

THE FULTON CO., of Knoxville, Tenn., through its representative, Frank C. Reeder, showed a full line of the Sylphon valves used for radiator work, the Regitherm for regulating the temperature of rooms, the tank regulator for keeping the water temperature constant in tanks, and the air valve for taking the air out of radiators without allowing any leak on either pressure of vacuum systems.

THE WINEGAR BOILER COMPOUND CO., of Syracuse, was represented by C. H. Winegar, the proprietor.

STRONG, CARLISLE & HAMMOND had a most interesting exhibit of specialties, including all the 4/S line, but particular attention was called to the Strong engine stop and automatic safety device for stopping engines on overspeed or accident, and to the Strong vacuum trap which is arranged with automatic ball valves to drain the water from vacuum lines without cutting down the vacuum. L. P. Strong, the inventor of the specialties, and A. B. Pinney, of the New York office, were present.

THE FAIRBANKS CO. of New York exhibited a line of valves, wrenches, scrapers and other engineers' and mill supplies.

THE KEYSTONE LUBRICATING CO. and its product, Keystone Grease, were well in evidence, A. D. Page, the New York state manager, being in charge of the exhibit, and Mrs. Page serving as aid when Mr. Page was obliged to be away.

THE PENBERTHY INJECTOR CO. showed samples of small and large injectors of its manufacture and also of the watch fobs which it is giving away with the Penberthy Engineer.

SPENCER NEEMES was present, representing Neemes Brothers, of Troy, N. Y., and showed a working model of the Neemes shear cutting grate and also of the injector steam blower for forcing air in under the boiler. Mr. Neemes reported the recent sale of 10 sets of grates 6 by 6 ft. each to the American Woolen Mills, this being an order for grates under new boilers after the grates had been in use for some time under older boilers installed in the mills of the same company.

CHAPMAN VALVE CO. distributed catalogs and folders showing the full line of valves which it makes and exhibited sections of small gate valves showing the details of construction. A new device of the company is the Morris blowoff valve for boilers with renewable soft metal ring in the disk and renewable bronze seat ring in the body.

BILL SCHATZ AND BILL'S DOG "BILL" were, as usual, in great favor with the ladies, but Bill's dog carried on so reckless a flirtation, winking at everybody who passed by, that Bill finally had to bundle him up and carry him back to New York. Nevertheless, the damage had been done and everybody knew that the W. B. McVicker Co. are chemical engineers and make a specialty of boiler compounds because Bill and Bill's dog said so.

THE CARBOHYDRIDE CO., of Syracuse, was represented by E. B. Darrow, general manager of the company, and presented to the consideration of engineers an entirely new product. This was Standard black paint composed entirely of mineral substances, graphite and mineral oils and metal oxides, for use in the painting of boilers and stacks. Two grades are made, the low flash and the high flash, the low flash being for use on stacks, while the high flash is for handling around open fires to be put on while the iron is still hot. These paints give a bright luster to the surfaces and will withstand high degrees of heat.

THE SYRACUSE RUBBER CO. presented a line of Eureka fire hose, and of gaskets, coil and spiral packings, sheet packings, etc., of Rainbow and Eclipse brands, made by the Peerless Rubber Co., of New York. Herbert Self distributed "red core" pipes for the Peerless Co., the special feature of whose exhibit was the Uncle Sam poster recently gotten out by Stephen H. Roberts, the advertising manager of the company. J. Henry Glissman was the representative of the Syracuse Rubber Co.

JENKINS BROTHERS' exhibit was in charge of Frank Martin, assisted by Billy Murray and F. J. Murphy, the exhibit consisting of '96 sheet packing, Jenkins valves and catalogs of these and the numerous other products of the company. The pamphlets on Engineers' Joints and Jenkins Valves were particularly attractive.

THE SYRACUSE SUPPLY CO. distributed at its headquarters catalogs descriptive of the various lines which it carries, these including the Skinner engines, Murray Corliss engines, International steam pumps, Cochrane open feed-water heaters, Wainwright closed feed-water heaters, Phoenix Iron Works boilers, Strong traps, Crocker-Wheeler dynamos, etc.

C. H. TRUMBLE represented the Strong Chemical Co.

MARCO PACKINGS were shown in a full line in regular heavy boxes in which they are shipped and which prevent all damage to the packing in transit. The special features were the wound wedge for the cushion type and the flax packing with friction coverings for hydraulic piston and valve rods. W. L. Sanders, manager of the Packing Department of the Mechanical Rubber Co., was present and furnished pipes for smokers.

S. J. Hamilton, manager, and E. E. Reilly. For Power, C. W. Dibble, Wm. V. R. Van Kleeck, F. R. Low, John W. Armour and Henry Barnes. For the Southern Engineer, C. W. Hill.

THE HOME RUBBER CO. was represented by Richard Foley.

THE SYRACUSE ENGINE CO. showed several of its Syracuse single and multicylinder marine gas engines.

PENNSYLVANIA ENGINEERS' CONVENTION

PENNSYLVANIA State Association of Engineers held its tenth annual convention at Erie, Pa., June 4 and 5. The convention was one of the largest and most successful ever held and Erie was voted by all visitors as a splendid convention city.

Opening

John M. Lynch, secretary of the local branch, called the meeting to order on Friday morning and welcomed the visitors to the city, outlining the program of entertainment and introducing Mayor Liebel, who spoke of his pleasure in receiving the engineers to the city, called attention to the large number of skilled men employed in the industries of Erie and complimented the association on its principles, and its work.

ERIE CONVENTION, DELEGATES AND VISITORS

THE ANDERSON STEAM TRAPS, made by the V. D. Anderson Co., of Cleveland, were a prominent feature and all those which were on exhibit at the hall were sold to Edward Joy for use in the new Onondaga Hotel which is now being built in Syracuse. L. H. Rumage, of Buffalo, was the representative.

CRANDALL PACKINGS were represented by J. D. Loveland, of Palmyra, sales manager of the company.

FOR THE STANDARD OIL CO. there was present F. R. Paine, of Albany, N. Y., who gave to the delegates convenient folding pocket pipes.

JOHN A. ROEBLING'S SONS CO. was represented by G. W. Swan and Thos. C. Nash.

A NEW WATER GAGE, the Miser-Shaff automatic safety, was exhibited by the Miser-Shaff Specialty Co., of Watertown, N. Y., represented by F. K. Cooper.

FOR THE VARIOUS PAPERS there were present, for Practical Engineer, Edward R. Shaw, president of the Technical Publishing Co., Arthur L. Rice, managing editor, and John P. Smith, Jr. For the National Engineer,

Past National President Chas. H. Garlick, of Pittsburg, responded to this address, expressing the appreciation of the delegates for the work that the local association had done and reviewing the history of the national association.

The convention was then turned over to State President John D. Lewis, who, after a short talk, introduced National Treasurer S. B. Forse, of Pittsburg, who spoke of the importance of the exhibits at the convention. Following this Henry Sims, of The Sims Co., also emphasized the good resulting to all from a close inspection of exhibits and seconded the welcome given by Chairman Lynch and Mayor Liebel of the delegates to the city.

Afternoon Trip

After appointment of committees the convention adjourned until afternoon when the delegates and guests took a special trip to the west side of the city visiting the various industries, including the plants of the Skinner Engine Co., the Erie Engine Works, the Union Iron Works, the fine plant of the Ball Engine Co., the works of the Erie Foundry Co. where the Erie stoker is built, then back to the plant of the Erie City Iron Works, where are manufactured Erie City boilers, separators, feed-water heaters and engines, and to the shops of the Nagle-Corliss Engine Co.

In the evening a fish supper was served at the Engineers' Hall, at which all made merry.

Saturday

Saturday morning the convention was called to order and election of officers and installation was in place for the next year's meeting. The choice of president resulted in the conferring of that honor upon John M. Lynch, of Erie, an honor which, as stated by S. B. Forse, of Pittsburg, was well deserved and had been faithfully earned. Mr. Lynch has been one of the most capable workers in the engineers' organizations of Pennsylvania and his personality is such as to make him an ideal presiding officer.

Other officers chosen were: Vice-president, F. A. Zimmerman, of Pittsburg; secretary, D. E. Seeley, of Du Bois; treasurer, Richard Pape, Philadelphia; conductor, Chas. Flint, Scranton; doorkeeper, John C. Dallas, Sharon. The place of meeting for next year was chosen as Scranton, and officers were installed by National Treasurer Samuel B. Forse, of Pittsburg. The purchase and presentation to the retiring president, John Lewis, of Sharon, of a past president's jewel was authorized, this duty being turned over to John Dallas, of Sharon.

President Lynch appointed as license law committee F. M. Zimmerman, of Pittsburg; A. J. Clark, of Scranton, and Frank Duemler, of Philadelphia. Final adjournment of the business session was taken at noon, and in the afternoon visitors were entertained with a trip on the bay and a visit to the life-saving station, water works and other points of interest. The evening was spent on a trip to Four Mile Creek and Waldemere and in social enjoyment.

The Banquet

At the banquet on Friday night about 100 delegates and local men were present besides manufacturers and their representatives. S. B. Forse, of Pittsburg, acted as toastmaster, and remarks were made by Mayor Liebel, of Erie, by Vice-President John M. Lynch, by John A. Kerley, of Cincinnati; by F. R. Low, of New York; G. F. Duemler ,of Philadelphia; Jos. N. Gregory, of Buffalo, and Chas. H. Garlick and George Brownhill, of Pittsburg. The humorous part of the entertainment was contributed by Jack Armour.

Exhibits

Exhibits were numerous and of a high order, the following firms being represented: Northwestern Pipe & Supply Co., of Erie; V. D. Anderson Co., of Cleveland; H. P. Weller, of Erie; The Lunkenheimer Co., of Cincinnati; the Sims Co., of Erie; Jenkins Bros., of Philadelphia, which occupied two exhibits; Erie Mfg. & Supply Co., of Erie; Greene, Tweed & Co., of New York; H. W. Johns-Manville Co., of New York; the Garlock Packing Co., Palmyra, N. Y.; Hill Publishing Co., New York; Atlantic Refining Co., of Erie; Home Rubber Co., of Trenton, N. J.; Quaker City Rubber Co., of Philadelphia; Jarecki Mfg. Co., of Erie; Wm. Powell Co., of Cincinnati; Trill Indicator Co., of Corry; Morgan Mfg. Co., of Erie; Arandsee Machine Co., of Erie; Judge Boiler Compound Co., of Erie.

HOBOKEN CONVENTION OF THE NEW JERSEY STATE ASSOCIATION OF ENGINEERS

NEW JERSEY STATE CONVENTION

THE 18th annual convention of the association, held in Hoboken, N. J., Saturday, June 5, 1909, at 1 p. m., was opened by National Vice-President Renolds, who introduced Mayor Steil. He extended a cordial invitation to the delegates and friends and concluded by inviting them back again, and gave them the freedom of the city. Recorder J. J. McGovern expressed himself as heartily in favor of securing a state license law.

Herbert Stone responded to the invitation to address the delegates, speaking of the benefits to be derived from the state association and the necessity of a state license law.

The convention was then turned over to State President Callahan, who called the meeting into permanent session and responded to the address of welcome.

He then appointed committees, and reports of officers and committees were taken up.

The educational committee reported the securing of 5 lecturers from different manufacturing companies, and recommended that provision be made by all associations for the use of the state association's stereopticon, making all lecture nights open meetings and giving the lectures as wide publicity as possible.

Per capita tax of 10 cents a member was adopted.

Reports of treasurer and secretary showed a good year's work accomplished and a substantial balance on hand.

After considerable discussion, it was decided to make the date of convention the first Saturday in June at 3 p. m.

to enjoy the hospitality of Hoboken Association.

Entertainment was in order for an hour, consisting of songs by Herbert Self of the Peerless Rubber Co., Charles Webb and Billy Murray of Jenkins Bros., Charles Thompson and John Force.

A visit to the docks of the North German Lloyd Steamship Co. occupied a couple of pleasant hours, and refreshments were then served.

Attractive booths were arranged by the following exhibitors and their representatives: The Lunkenheimer Co., by W. A. Renolds; J. W. Mathews Boiler Compound Co., by J. C. Herrmann; Ashton Valve Co., by Frank J. Corbett; Jenkins Bros., by Frank Martin and Frank E. Sass; Fulton Company (Sylphon Specialties), by Frank C. Reeder; Dearborn Drug & Chemical Co., by H. E. Stone; Chapman Valve Co., by Frank Barry; Keystone Grease Co., by J. Jackson; McLeod & Henry Co. (Steel Mixture), by John Foote and F. Tuthill; Peerless Rubber Co.,

HOBOKEN CONVENTION OF NEW JERSEY STATE ASSOCIATION OF ENGINEERS

A short time was taken for the exhibit, and on reconvening at 5 p. m. the place of meeting, as between Newark and Jersey City, was chosen at Jersey City.

Election of officers resulted in: President, A. L. Case, Plainfield; vice-president, E. W. Sears, Newark; treasurer, J. J. Durkin, Hoboken; secretary, J. J. Reddy, Jersey City; conductor, R. De Groth, Elizabeth; doorkeeper, P. T. Mooney, Jersey City.

At the sessions on the 6th, a memorial service was held for deceased members, and appropriate resolutions adopted.

The secretary was authorized to procure a past president badge and present it to President Callahan at his convenience, and at future meetings to have such badge for presentation to the president when retiring.

Discussion on the appointment of a state deputy resulted in leaving the matter to the delegates to the national convention.

President Callahan's report spoke of the growth of the association, of its principles, sure building, on which has meant continued progress. He spoke also of the work accomplished in the state during the year in visiting associations.

Past National President Jos. F. Carney then installed the new officers, and the convention adjourned

by Robert Thompson and Herbert Self; Eureka Packing Co., by Frank J. Bloomer; W. B. McVicker Co. (Chemical Engineers), by Billy Schatz.

N. A. S. E. CONVENTION

At Columbus, Ohio, will be held, September 13-18, the annual convention of the National Association of Stationary Engineers, and in connection with this will be arranged an exhibit of power plant apparatus under the auspices of the National Exhibitors' Association.

The Exhibitors' Association has just issued a pamphlet descriptive of the work of both associations and explaining to manufacturers the advantages of being represented in the exhibit hall. The arrangements for the exhibit are in the hands of the exhibitors' officers: President, Herbert E. Stone, Dearborn Drug and Chemical Works, New York; vice-president, W. G. Le Compte, Jenkins Bros., New York; treasurer, M. B. Skinner, Jas. McCrea & Co., Chicago; secretary, W. D. Purcell, Quaker City Rubber Co., Philadelphia; executive committee, Edward McCarthy, Geo. W. Lord & Co., Pittsburg; W. D. Rigdon, Revere Rubber Co., Boston; Herbert Self, Peerless Rubber Mfg. Co., New York. Full information as to terms, space and arrangements can be had from the secretary.

NEWS NOTES

THE ENGINEER'S BLUE CLUB of Jersey City will hold its annual outing and games on Sunday, July 11, 1909, at Eitner's Park, Grant City, Staten Island.

THE NEW YORK OFFICE of the Murphy Iron Works has been removed to Room 1671, Hudson Terminals Building, which is at No. 50 Church street. The manager for this district will be H. W. Canning, formerly representing the company in Birmingham. The telephone is No. 5108 Cortlandt.

F. W. JACKSON has been appointed district manager for the Baltimore district of the Harrisburg Foundry & Machine Works, with headquarters at 415 Continental Trust Building. He has been in the engineering and sales departments of the company for a number of years, hence is well qualified to take up the engine details of any installation.

HOYT ELECTRICAL INSTRUMENT WORKS, of which the home office and factory are at Penacook, N. H., has been obliged to move its New York office in order to secure more room. On June 1 this was removed to 136 Liberty street, where the increased space and facilities will enable the company to handle all business quickly and satisfactorily.

THE PEAT ENGINEERING CO., consisting of Ernest V. Moore, a graduate of McGill University, Herbert Garnett, of the American Peat Society, and Francis J. Bulask, president and general manager of the Commercial Artificial Fuel Co., has been organized to furnish advice and information to any who may wish to take up the question of developing peat beds as sources of fuel in any part of the country. The office will be in the St. Clair Building, Toledo, Ohio.

THE ROYAL WEAVING CO., Pawtucket, R. I., is about to build a power plant. The plans and specifications, prepared by Charles T. Main, mill engineer and architect, of Boston, Mass., call for a power house 98 by 64 ft., with basement, and boiler house 93 by 47 ft. The generator equipment is to consist of 3 500-kw. Allis-Chalmers turbine units. In the boiler house will be installed 4 350-hp. B. & W. boilers. The building is to be of brick with reinforced concrete roof over the boiler house. The stack will be of red brick 175 ft. high with 8-ft. flue.

THE MACBETH IRON CO. and the Bruce-Meriam-Abbott Co., both of Cleveland, consolidated their interests on June 1 under the name The Bruce-Macbeth Engine Co., and will continue their work as builders of gas engines and blowing engines, engineers, founders and machinists.

BOOK REVIEW

ELECTRIC RAILWAY POWER STATIONS. By C. M. Swingle. Chicago, 1909; 700 pages; 368 illustrations; 5 by 8 in.; cloth binding; $2.

The plan of this book is admirable for anyone wishing to study the subject. First a description is given, treating of some topic, and following that is a series of questions based on the text which must be studied to give the answers asked for, so that it is of value as a reference book, and also as a catechism.

The subjects taken up are: Steam Boilers, 106 pages; Feed Water Heaters, 18 pages; Boiler Auxiliaries, 34 pages; Stokers, 27 pages; Chimneys, 10 pages; Combustion, Flue Gases, and Testing of Boilers, 75 pages.

In the section on Steam Engines, a description of details is given, followed by a section on the Use of the Steam Engine Indicator, by another on Valve Adjustment, a chapter on the Steam Turbine, and a section on the Gas Engine and Producer. The dynamo is treated from its elementary principles, up through the details of construction of the different parts of modern railway generators, including commutator, armature, and brush-holders and their mountings. A section of 30 pages treats of switchboards, and one follows of 26 pages on Substation Equipment and Management; the final section is one on Switches and Meters.

It is a book that anyone can understand. It is a book in which anyone will find much information and almost anyone a good deal of information that he did not before possess. It is an interesting book to read, and is written by a man who is competent to write. It is a good book to have and to keep handy for reading and for reference.

HOUSE HEATING BY STEAM AND WATER. New York, 1908, 260 pages, with illustrations, cloth binding, price $3.

This is a practical book written by practical men for practical men. While it is entitled House Heating, it takes up also the heating of buildings other than houses, such as small factories, office buildings and school houses.

It starts with the heat loss and the radiation needed for a building, showing how to compute this, the comparison of direct and indirect systems, works out examples for various residences, stores and shops, showing the amount of material needed and the cost, takes up the piping and placing of radiators, showing the general plan for piping and the arrangement of details with both basement feed and overhead systems of 2 pipes or for 1 pipe. It deals also with vacuum heating for houses, cost of steam and water heating as compared, submerged return boilers and the value of the heating surface for steam and hot water is also compared. It gives the method of determining capacities for boilers, fuel consumption which should be expected, the piping up of steam heating boilers, and gives suggestions as to the heating of swimming pools, water for greenhouses, the sizes of steam mains and of water heating mains and the details of installations.

GENERAL LECTURES ON ELECTRICAL ENGINEERING, by Chas. P. Steinmetz. Schenectady, 1909; 280 pages, with illustrations and diagrams, cloth binding, price $2; with a colored frontispiece illustration of Dr. Steinmetz.

To anyone at all familiar with electrical matters it is needless to say that Dr. Steinmetz stands at the head of the electrical engineering profession today. His knowledge of the entire field is so profound and his grasp of even small details so perfect that there is no subject which can be mentioned on which he is not competent to speak and to speak at length.

The lectures embodied in this volume are in part those given to students at the Union University in Schenectady, where Dr. Steinmetz is professor of electrical engineering, and in part popular lectures delivered throughout the country. They have been collected and carefully edited by his assistant and have the authorization of Dr. Steinmetz.

The first chapter gives a good view of the field of use of electricity, the standards used and the comparison of alternating and direct current. The second chapter compares the advantages of direct and alternating current distribution, discussing when it is advisable to use each.

The third lecture is devoted to the subjects of light

and power and the availability of direct and alternating current for these uses. The fourth lecture discusses the load factor and cost of generation of electricity, the fifth takes up long-distance transmission, the losses in the line and in transformation, the different methods of connecting transformers and the details of line construction.

So the series of lectures goes on, taking up in detail, but in a way which can be understood by the general reader as well as by the engineer, the different branches of electrical practice. Among these are the generation of electricity by water power and by steam power, and the characteristics of generators, the use of synchronous machines and the difficulties encountered, regulation and control of machinery, protection of apparatus against lightning, machinery for electrical railways and comparison of direct and alternating current motors for this kind of work, electrochemistry, incandescent and arc lamps and their proper use, illumination and the proper distribution of light, and a full discussion of the properties of lightning and how it may be guarded against when protecting buildings.

The book is a better piece of artistic printing than is ordinarily found in a technical work, a clear type and soft surface book paper and good spacing making it easy on the eye. It is a good book for one who wants a clear idea of what electricity is doing in the modern world.

STEAM POWER PLANT ENGINEERING, by G. F. Gebhardt, New York, 1908; 800 pages with full illustrations and a complete index. Cloth binding, $6.

This book is deserving of the highest praise and the power plant industry owes to Prof. Gebhardt a debt of gratitude for having placed at its service a compendium of current practice in the different departments of the power plant. The book opens with a general discussion of the elements of the plant, showing the simple type noncondensing, with and without a heating system; condensing simple, and condensing with all possible devices for heat saving.

In the chapter on fuels, as all the way through the book, one of the most valuable features is the complete references to books and periodicals where information on the subject may be found. The chapter on fuels discusses the different kinds, the losses which are incurred from overair supply and from nonburning, the effect of the ash contained in a fuel on its heating value, the use of powdered fuel, methods of using oil fuel and the details of burners for such work. Each of these subjects is discussed at length, giving a concise, yet complete synopsis of knowledge and current practice.

In the chapter on boilers, types, details of settings, the power of boilers, capacity and efficiency, proper thickness of fire, the effect of different kinds of settings, the styles of grates used, and the auxiliaries in common use are thoroughly gone into. In fact, this same statement may be made in regard to every chapter of the book and the only way to give an idea of the work that has been done in preparation is to say that it is all well written, it is practically complete in every department and the subjects covered are briefly as outlined in the following abstract of topics:

Under Furnaces, Stokers and Smoke Prevention the details of all types are given; superheated steam, superheaters, the limit of superheat, details of application, surface needed, gain from superheating; under Coal and Ash Handling Machinery, details of apparatus, the arrangement of systems; under Chimneys, draft and rates of combustion of coal, comparison of formulas for chimney capacity, description of types of chimneys, details of brick, steel and concrete construction, and discussion of the stability of chimneys and details of foundations; under Mechanical Draft, full details and methods of applying the different systems in use and size fans required; under Engines, the thermal laws which govern them, the losses from condensation of steam in the cylinder and clearance, incomplete expansion, friction, the elimination of these losses by reheating, the use of jackets, multiple valves, compounding, condensation and the cost of engines; for turbines, the principles of the steam turbine, types, details of nozzles, blades and governors, the application of low pressure steam turbines, the influence of superheat and vacuum on the efficiency; under Condensers is discussed why they are used, how they are used, the different kinds and makes, the surface required, the amount of cooling water required, high vacuum systems for steam turbines, methods of cooling water and the costs of installation; under Feed Water Heaters and Purifiers, the effect of impurities, removal of impurities, formation of scale, the arrangement of purifying plants, use of boiler compounds, economy of heat, heater details for both open and closed types, economizers, the choice of a heater system and the cost; under Pumps, duplex and single cylinder types with pistons and with plungers, the details of steam valves, the steam consumption of pumps and the capacity of boiler feed pumps, pump auxiliaries such as governors and feed water regulators, the use of power pumps, feeding by injectors, wet and dry air pumps, centrifugal and turbine pumps, rotary pumps and the use of the air lift; under Draining are discussed the details of separators, traps and systems of piping, a special chapter being devoted to pipe and fittings which takes up the different pipe sizes, threads, provision for expansion, supports and anchoring, the arrangement of pipe systems, the flow of steam, the arrangement of exhaust piping, vacuum systems for heating, the flow of water in feed water piping and different kinds of valves used, including nonreturn, stop valves, blowoff valves, safety valves, back pressure and relief valves.

Lubricators and Lubrication take up the different kinds, the solid and liquid lubricants, desirable qualities in each, the methods of testing and applying and styles of lubricators. Under Finance and Economics a chapter on the cost of power is given which, while not so long as some, has involved an immense amount of labor. The matter of keeping records, determination of output, cost of operation and the different items that go to make up this cost are discussed at length and examples from different plants with tables of cost are given, fitting almost any set of conditions.

Testing and Measuring treats of the instruments needed, the methods of making tests on the machinery throughout a plant. Typical specifications are given for an engine and boiler, a condensing plant and piping system and for the purchase of coal. Descriptions follow of several typical stations with appendices giving a complete set of references on power plant matters, the rules for conducting boiler and engine trials, steam tables, conversion tables and values of mechanical and electrical units.

The book is up to date, is complete, understandable by anyone throughout the greater part. In some places there are equations and formulas used, but only where this is absolutely necessary, and these do not in any way interfere with the value of other parts of the book to one who does not readily handle mathematics. It is a good book for the young engineer just begin-

ning and for the old engineer who wants to know about the new things.

A characterization of the book worth while repeating is that of Prof. L. P. Breckenridge, of the University of Illinois, who has for many years been engaged in the field of which the book treats:

"I know of no new book which approaches this in completeness, and which gives such careful attention to the important details of the subject. I am sure that you will find that engineers and technical schools in general will use this book very largely for reference and text-book work."

CATALOGUE NOTES

H. W. JOHNS-MANVILLE CO. has issued several publications which, like all the printed matter from that company, are interesting and full of information. One of these describes the Permanite sheet packing which is a new quality for high pressure recently perfected. This is furnished in sheet form or as gaskets. The second pamphlet describes the Natural Compressed sheet cork and Keystone hair insulator for refrigerating plants and apparatus made by the company, and a third is in regard to the J.-M. asbestos roofing which is made up of layers of asbestos and asphalt cement, thus giving a roof covering which is fire-resisting and water-tight.

SURFACE CONDENSERS is the title of a 24-page 8 by 10.5 in. booklet just published by the Wheeler Condenser & Engineering Co. The contents include an interesting chapter on the economy of running condensing, another on the advantages of the several types of condensers, followed by a description of the Wheeler surface condensers with some remarks on the relative advantages of rectangular and cylindrical shells. The Volz Combined Feed Water Heater and Condenser, in which some of the tubes serve as a primary heater, is next described, after which there is a section on turbine condenser outfits. The final part of the catalog is devoted to notes and suggestions on the installation and operation of surface condensers. The illustrations, of which there are a large number, show not only the various types of Wheeler Admiralty and Wheeler-Volz surface condensers of the rectangular and cylindrical patterns, and waterworks condensers, but also include a considerable number of the largest steam power plants in this country. This booklet, which forms one of a series of engineering treatises which the Wheeler Condenser & Engineering Co. is distributing, will be of interest and value to any engineer who is called upon to design, construct or manage steam plants.

ALUMINUM ELECTROLYTIC LIGHTNING ARRESTERS are manufactured by the General Electric Co., Schenectady, N. Y., for all voltages up to 100,000 and are designed to protect electrical systems from all lightning disturbances, considering lightning in the broadest sense. Bulletin 4595 describes the Form 1 arrester which is now being placed on the market.

BALL-COOLEY ENGINEERING CO., of New York City, is bringing out a new type of engine, which it calls, "The Ever Ready Fool Proof;" it is made in three types: the Industrial for belt driving; the Simple type for direct connection to blowers, dynamos, centrifugal pumps, etc., and the Reversible type for use with cranes, automobiles and boats. All types are made in sizes from 1.5 to 12 horsepower, and are described in a booklet just issued.

GIBSON IRON WORKS, of Jersey City, which manufactures dumping, shaking and stationary grates, and also the Gibson Common Sense Spiral Steam Blower, issues a folder describing its various products, which engineers will find of interest.

AKRON FRICTION CLUTCHES and clutch couplings are simply but completely described in a pocket size catalog issued by the Williams Foundry and Machine Co. of Akron, O. The roller toggle is a novel and interesting feature.

THE STRONG MOTIVE POWER SPECIALTIES, made by the Strong Machinery & Supply Co., include all kinds of steam specialties, packings and supplies. They are described in a 250-page catalog issued by the company from New York City.

THE NORTH AMERICAN BOILER CO. of Chicago, manufactures the Improved Standard Safety Boilers, which are of the inclined water-tube type with horizontal steam drums, the tubes being carried front and back by vertical headers set in staggered rows. The construction is fully described in a handsomely illustrated catalog.

THE LINTON MACHINE CO., 26 Cortlandt St., New York, is sending out a booklet descriptive of the Komo steam trap and showing new sizes in which this trap is now made. It is an interesting little book and one that those who write for it will be glad that they got. The Linton Co. is handling the Komo trap for the entire United States.

IN BULLETIN NO. 4,659, just being issued by the General Electric Co., are described some switchboard instruments for use on alternating current circuits, and constructed on the induction principle. Ammeters, voltmeters and wattmeters are made in this type of instrument, and are constructed so as to be uninfluenced by stray fields. Indications of the pointer are rendered dead beat and the scale extends through an arc of 300 deg. and is practically uniform throughout. This bulletin contains catalog numbers, prices and dimensions of this instrument.

MORE AND MORE as the efficiency of power pumps is recognized and as the use of electric current for driving auxiliaries becomes general does the triplex power pump become common in station practice. The Goulds Mfg. Co., of Seneca Falls, New York, is one of the largest manufacturers of such pumps in the country, and in a new catalog of 190 pages just issued the entire line of pumps and pumping apparatus is fully described and illustrated. The line includes belted and motor-driven geared pumps, single and double acting for all conceivabe purposes, pressures and locations. Centrifugal as well as reciprocating pumps are shown and the sizes and capacities of the different types listed. It is a beautiful and instructive book with attractive binding and cover, and contains several valuable tables of water and pump valves. It is a handsome and durable book for the engineer's library.

BULLETIN FROM THE UNIVERSITY OF ILLINOIS gives the conditions for entrance and the course of study in the School of Railway Engineering Administration at the University. It shows also, by halftone illustrations, the very attractive outfit for the making of tests and experimental investigations which the company has available for students. The bulletin can be obtained by writing direct to the University at Urbana, Ill.

FROM THE UNDER-FEED STOKER CO. OF AMERICA comes an interesting booklet entitled "Some Jones Stoker Plants in Iowa." This was espe-

cially prepared for the meeting of the Iowa State Association, N. A. S. E., at Cedar Rapids, but the information given in regard to the plants and the results obtained from them are of interest to steam users in any locality. It shows the results that have been accomplished in burning low grade fuel, while at the same time avoiding the production of smoke.

CATALOG NO. 13 OF THE Alberger Condenser Co. is devoted to a description of the Wainwright Water Heater, used for hotels, apartment buildings and factories, which takes the exhaust steam from elevator pumps, light engines, house supply pumps and so on, and heating such water as may be needed. Brass, iron and copper are the only materials which come in contact with the water and steam. In the Wainwright heater the water travels not only in a zig-zag course through the tube, but back and forth through several nests of tubes, until it gets to the proper heat needed for the conditions. The tubes are of copper with corrugations which increase the surface, and are of small diameter so that the flow through them is rapid, giving a more efficient activity of heating. Besides the Wainwright Heater, the Wainwright Water Heating System is also described, and the Wainwright Method of Automatic Control.

FROM THE COVER OF CATALOG P issued by the Ball Engine Co., of Erie, Pa., the embossed representation of the Ball side-crank engine stands out in an attractive design, and gives invitation to investigate further which one is glad to accept, and is afterward glad that he has accepted. The details of the engine are interesting and interestingly described. The illustrations are fine and tell their story well. Engraver's and printer's arts have been well combined to make a handsome book. Best of all it tells a real story about a piece of good engineering work. Those interested in steam engines should write for it.

KEYSTONE HAIR INSULATOR is a sheathing for use in house building, and the J. M. Regal roofing is a well-known preparation covered with natural asphalt combined so as to withstand oxygen, sunlight, wind, rain, snow, heat and cold. These 2 products of the H. W. Johns-Manville Co. are interestingly described in 2 folders just received.

THE MONTHLY STOCK LIST of the Scully Steel & Iron Co. of Chicago is at hand and includes the regular full line carried by the company of iron shapes of all kinds and descriptions, boiler construction material and tools, and small tools for power plant work.

OILDAG is the name given to a lubricant consisting of graphite and oil, prepared by the International Acheson Graphite Co. of Niagara Falls, N. Y. In a book just issued is contained the report of Prof. C. M. Maybery of Case School of Applied Science as to the merits of this new combination as a lubricant. Some of the conclusions drawn are that for the same load carried on a journal with and without graphite, the consumption of oil may be reduced at least 0.5; that the reduction of friction is at least 25 per cent when using Oildag, with an equivalent saving in power; that the low coefficient of friction shown by fuel oils, foretells the wide use of fuel oils as lubricators. Tests made by the Graphite Committee of the Automobile Club of America show that by the use of graphite mixed with lubricating oil in the cylinders of the engine not only was the speed of the piston increased, and therefore the horsepower, but the smoke from the exhaust is decreased, the compression in the cylinders is better held, and the life of all the bearings is lengthened.

THE CURTIS & CURTIS CO. of Bridgeport, Conn., manufactures the Forbes Patent Side Lock and other pipe-cutting and threading machinery for hand or power. In its catalog just issued the company describes and illustrates the apparatus by which one man can cut off and thread 12-in. pipe by hand without the use of any extra pipe vise. Arrangements for power driving as well as for hand driving are shown and also a set of smaller auxiliary apparatus, such as the patent nipple holder, a reversible ratchet drill, pipe cutter, side locks, pipe vises, etc., are included in the catalog.

THE BALL & WOOD CO. of Elizabethport, N. J., has issued a pamphlet which describes the Rateau-Smoot turbines and separators for the use of low-pressure steam.

THE JUNE CALENDAR of the Stephenson Bar Belt Dressing, made by the Stephenson Mfg. Co. of Albany, N. Y., is a painting by Manning entitled "Marjorie," which is a girl's figure appropriate to the season of the year.

STATION TRANSFORMERS is the title of Bulletin 86, issued by the Wagner Electric Mfg. Co. of St. Louis.

FROM THE A. S. CAMERON STEAM PUMP WORKS, foot of East 23d St., New York City, comes a novelty in the form of a convenient double key ring, which will be sent on application to the works. It is a mighty handy little device.

"LUBRICATION VERSUS FRICTION" is the title of a handsome new booklet issued by the Dearborn Drug & Chemical Works, whose New York City address is 299 Broadway, and the main office in the Post Telegraph Bldg., Chicago. This book deals with the kinds of lubricants consisting of liquid, semisolid and solid, shows the sources from which they are derived, tells about steam cylinder lubrication, engine and dynamo lubrication, the physical properties of lubricants, showing how they may be determined, fire tests of lubricants, friction tests of different oils, and the chemical examination of lubricants.

The Dearborn Laboratories are illustrated, and a final article on the selection of lubricants gives many interesting points. A table is included showing the comparative differences in physical properties and market prices of some of the well known crude petroleums of the U. S.

NATIONAL ELECTRIC LAMP ASSOCIATION of Cleveland, Ohio, sends out through its engineering department a data booklet upon carbon, tantalum and tungsten incandescent lamps.

BULLETIN NO. 30, on the rate of formation of carbon dioxide in gas producers, by Dr. J. K. Clement, L. H. Adams and Dr. C. N. Haskins, has just been issued by the Engineering Experiment Station of the University of Illinois. The problem attacked by the writers of this bulletin was the determination, so far as possible, of the factors that govern the production of carbon dioxide in gas producers.

In the experiments performed, carbon dioxide gas was passed through a porcelain tube filled with either charcoal, coal, or coke, and heated in an electric furnace. The time of contact could be varied at will, and by changing the current a temperature variation was obtained.

It was found that the production of carbon mon-

oxide formed depends upon the temperature and the time of contact of gas and carbon. With ordinary depth of fuel bed a high percentage of carbon monoxide requires a high temperature—2400 deg. F. or above.

Copies may be obtained gratis upon application to the Director, Engineering Experiment Station, Urbana, Illinois.

A NEW FOLDER ISSUED BY THE International Acheson-Graphite Co. is known as 273D. It is descriptive of the company's Graphited Greases, products which are designed for gear, cup and ball bearing use. In the manufacture of its Graphited Grease, this company uses absolutely pure graphite, which is a perfect lubricant in itself. The graphite and grease are beautifully blended, and it is claimed that the resultant product will do far more work than any other grease product on the market, great value being given the combination by the superior lubricating qualities of the graphite.

THE INDUSTRIAL INSTRUMENT CO. supplies data on its instruments in the form of engineering bulletins, each bulletin being devoted to a certain line or class of meters, or to those instruments of different classes that group themselves conveniently for a certain industry. This method shares much of the elasticity of loose leaf catalogs without involving the trouble of their maintenance. It furthermore eliminates the formidable general catalog, only a small part of the contents of which is of interest to the average customer. The engineering bulletin treats one type or class of instruments exhaustively, without including irrelevant matter. The various bulletins published by this company are 8 by 11 in. in size and punched for binding together in substantial covers. These covers, or binders, and any bulletins will be sent to engineers interested in instruments upon application to The Industrial Instrument Co., Foxboro, Mass.

BULLETIN 27, from the Jacobson Machine Mfg. Co., Warren, Pa., describes the Jacobson gas and gasoline engines for stationary and portable use. These are made in sizes from 2.5 up to 27 hp. in the single cylinder type, and in the tandem automatic type are built in sizes of 30 hp. and over as may be required. The catalog, which has 24 pages, illustrates the different styles and shows the construction details.

PROPER CARE OF BELTS is a new booklet of 24 pages recently gotten up by the Joseph Dixon Crucible Co., Jersey City, N. J. It is divided into 3 sections, headed, respectively, Belts; Belt Dressings; and Hints, Kinks, Tables. The first section deals with the running condition of belts; the second takes up treatment with various preparations; and the third, as the title indicates, has some general points upon belting and its use.

This last section tells what results were secured in a plant where records were kept over a period of years; gives the economical speeds at which leather belts should be run; tells of the different styles of joints; contains rules for calculating speed of pulleys; gives horsepower transmitted by various sizes of single and double belts, etc.

Those desiring a copy of this booklet may secure it by writing to the Joseph Dixon Crucible Co., Jersey City, N. J., and mentioning this publication.

PURIFICATION OF BOILER FEED WATER is the subject of 2 charts reprinted from well-known authorities upon this subject, by the Harrison Safety Boiler Works, 3144 N. 17th St., Philadelphia, Pa. The charts show that the purification of water for boiler feeding purposes can be accomplished in a commercially successful manner by the proper application of heat and soda ash, that is, that these 2 remedies will entirely protect the boilers from corrosion and from the formation of hard scale, since boiler feed water should be heated in any case, and since heating water by spraying through steam takes the place of the caustic lime or caustic soda used in other processes for taking up carbon dioxide, this hot process system is claimed to be the rational method of converting cold, hard water into hot, soft water for boiler feed purposes. The hot process apparatus designed and built by the above company combines all the functions of an open feed water heater with those of a softening system, and the fact that a feed water heater should be installed in any case thus makes it comparatively inexpensive to secure softening in addition.

LEAD LINED AND TIN LINED iron pipe are described and illustrated in a folder from the Lead Lined Iron Pipe Co., Wakefield, Mass. This is designed specially for places where lead is needed to avoid corrosion from the contents and iron to prevent injury.

ENGINE ROOM GAGE BOARDS, when properly installed and of attractive design, are always a pleasure and a pride to the engine room force. Those shown in the new booklet issued by the American Steam Gauge & Valve Mfg. Co., of Boston, Mass., are all of them so well designated that they will prove a distinct addition to the engine room. The booklet is available for those interested in the subject.

FROM LOG TO LINE SHAFT sounds like the title of a book for boys, but this is no boy's book. It is an interesting story, however, gotten out by the Dodge Mfg. Co., of Mishawaka, Ind., and showing the process of manufacture of the Dodge Patent Wood Split Pulley from the time the timber is cut until the pulley is on the shaft. It is an attractive piece of printing work with a striking cover design, and tells things worth knowing.

FROM CROSBY STEAM GAUGE & VALVE CO. comes a circular describing the Branden Patent Pump Valve with wire coiled insertion.

SECTIONAL CONDUIT for covering underground steam systems is made by the H. W. Johns-Manville Co., and the features of the covering as well as examples of the durability of the material are shown in an interesting folder recently issued, which can be had on application to the company at 100 William St., New York.

THE 1909 CATALOG of the Detroit Lubricator Co. illustrates numerous styles of sight feed lubricators, plain or single feed or multiple feed, and arrangements for oiling crossheads, crankpins and other difficult bearings. Other steam specialties shown in the catalog are oil cups, low water indicators, water gages, radiator valves and low-pressure safety valves. The catalog is on a heavy coated paper with an attractive gray cover and contains 61 pages of text and illustration.

THE PUBLICITY MAGAZINE for May, issued by the Under-Feed Stoker Co. of America, has descriptions of power plants in several buildings and factories illustrating the installations of the Jones stoker for various kinds of boilers.

THE GENERAL ELECTRIC CO. has recently issued its bulletin 4663 covering Lightning Arresters for both alternating and direct current circuits.

The lightning arresters described in this publication were designed after careful consideration of the great variety of conditions and phenomena produced by lightning, including all effects of abnormal voltage. These arresters, designed upon an elaboration of Prof. Elihu Thomson's fundamental patents, consist of a series of spark gaps shunted by graded resistances but without series resistance.

Bulletin 4661 contains a description and numerous illustrations of aluminum lightning arresters for alternating current circuits. Dimensions and diagrams of connections for circuits of from 4600 to 110,000 volts are also shown.

These arresters are built up of a number of aluminum plates immersed in a suitable electrolyte and their most notable characteristic is what is known as the "critical voltage." This depends upon the hydroxide film of the aluminum on the surface of the aluminum plates, which, up to a certain voltage, allows an exceedingly low current flow. At a higher voltage, however, the flow is limited only by internal resistance of the cell, which is very low.

Bulletin 4669 illustrates and describes the various types of Curtis Steam Turbines for Low Pressure and Mixed Pressure. In addition to the illustrations of the turbines, this bulletin contains curves showing tests of an engine in combination with a low-pressure Curtis turbine, and a chart showing the power output and costs, which indicate the increased capacity and economy secured by installing low-pressure turbine sets.

MARTIN GRATE CO., Fisher Building, Chicago, is issuing a merry little pamphlet called The Grate that Jack Built, in regard to its product.

IN THE MAY ISSUE of The Dodge Idea, issued by the Dodge Mfg. Co., are shown applications of rope driving to heavy transmission and the use of Eureka water softening apparatus, this article being taken from the Practical Engineer for May.

THE AMERICAN STEAM GAUGE & VALVE MFG CO. has recently furnished the following equipment for the 3 new colliers built by the Maryland Steel Co.: 18 American Thomson Improved indicators; 3 10-in. chime whistles; 3 6-in. siren whistles; 12 3½-in. duplex pop safety valves; 3 2-in. single pope safety valves; 18 steam and water relief valves; 12 cylinder relief valves; 52 gages; 3 clocks; 6 counters.

The company has also furnished the following for the North Dakota, built by the Fore River Shipbuilding Co.: 6 clocks; 108 steam and vacuum gages; 2 counters; 68 valves.

TRADE NOTES

AT THE WEST ALLIS WORKS of Allis-Chalmers Co. there is great activity in the gas engine building line, as a result of recent orders crowding close upon others received since the first of the year, the units for which are now being assembled for shipment. Among the orders just booked are 3 gas engines, aggregating 1,000 hp. direct connected to 3 Allis-Chalmers electric generators, for the Palmetto Phosphate Co., Tiger Bay, Fla.; a gas engine of approximately the same size, with generators, for the Armstrong Cork Co.'s plant at Camden, N. J.; a 1,500-kw. gas-driven electric unit and 7 standard 30,000-cu. ft. gas-driven blowing engines for various blast furnace plants.

H. W. JOHNS-MANVILLE CO., New York, has taken the selling agency in the United States and Canada for the products of the American Hair Felt Co., which includes hair felt for all purposes. Baeder, Adamson & Co., Philadelphia, Pa., having discontinued the sale of hair felt. Henry J. Bellman, who for many years was connected with that branch of their business, has been appointed manager of the hair felt department of the H. W. Johns-Manville Co., with headquarters at 100 William street, New York.

THOMAS H. DALLETT CO. of Philadelphia reports business lively and sales good on its Dallett air compressors. The shops on a recent visit there proved this statement and are a model of effective arrangement for the turning out of work. The compressors are made in duplex form 1 or 2-stage as desired with strokes of 8, 10 or 12 in. and diameters to suit the specified capacity. Steam or belt driving is arranged according to the needs of installation.

RELIANCE ELECTRIC & ENGINEERING CO. is the new name adopted by the Lincoln Motor Works Co., of Cleveland, Ohio. The management remains the same as heretofore and the new company will manufacture the Lincoln variable speed motor and their lines of constant speed motors.

THE KEYSTONE CHEMICAL MFG. CO. of Philadelphia announces that it has removed its Chicago office to 648 First National Bank Bldg. and placed a new manager in charge. It also wishes to call attention to the fact that a former employe is trading under the name of the Keystone Chemical Co. Suit has been brought to protect its customers and prevent this deception. It will appreciate any information of instances where this has occurred.

THE AMERICAN STEAM GAUGE & VALVE MFG CO. has received from the Newport News Shipbuilding & Dry Dock Co. an order for 8 government composition triplex safety valves for Torpedo Boat Destroyers "Roe" and "Terry."

A similar order has been received from William Cramp & Sons Ship & Engine Bldg. Co., for 8 triplex valves for Torpedo Boat Destroyers Nos. 30 and 31.

THE BABBITT AUTOMATIC barrel filler as made with flexible metallic tubing is one of the new things brought out by the U. S. Flexible Metallic Tubing Co. of San Francisco, Cal.

DURING THE PAST 90 days Allis-Chalmers Co. has taken contracts for upwards of 30 steam turbines and generators, aggregating in capacity nearly 50,000 kw. and negotiations are now pending for more than double that number. Among the orders recently placed is one for a unit of 2,000 kw. for the Public Service Corp. of New Jersey, to be installed at Camden, another of 2,000 kw. purchased by the Stone & Webster Engineering Corp. for the El Paso Electric Ry. Co., El Paso, Tex., and a 2,000 kw. machine to be placed on a repeat order in the Public Service Station of the City of Columbus, Ohio.

RECENT SALES OF Bird-Archer Compound in Japan, China and the Settlements have been constantly on the increase in spite of strong competition and prejudice in favor of European, especially English, products. These American compounds first gained their prestige in the Orient through their ability to overcome successfully the severe conditions met with in the Philippine Islands, where magnesium and other

sulphates in the boiler feed water have always caused serious trouble. The presence of obstinate impurities and scale seems to be a characteristic of the average steam plant in China and Japan also, and carefully prepared compounds have proven beneficial beyond question.

SELECTION OF GOOD LUBRICANTS is one of the most important duties of the operating engineer. His responsibility to his employer, the power user, requires that the lubricant he chooses for a given service about his machinery must give the best return in value for its cost. The value of a pure mineral grease as a lubricant for pumping-station machinery is exemplified by the performance of Keystone Grease, manufactured by the Keystone Lubricating Co., Philadelphia, at a number of the largest private water companies in the vicinity of New York City, one of them being the Hackensack Water Co., operating 2 triple-expansion vertical Allis pumping engines at 170 lb. steam pressure, with a duty of 20 million gallons per 24 hr. against a head of 180 lb. This plant supplies a large section from Spring Valley, N. Y., to Weehawken, N. J. The pressure on the engine journals is 290 lb. per square inch. No. 4 density Keystone Grease is used on these engines, at a saving stated by the makers to be 52.5 per cent in cost of lubricant over the lubricating oil formerly used, and with positively no increase in the friction load. There is also a decided saving of labor, and of mess under the pumps. This water company is now putting in a new 12 million gallon unit of the same type, which will also be lubricated with Keystone Grease.

INTERNATIONAL ACHESON GRAPHITE CO., of Niagara Falls, N. Y., has commenced an action in the United States Circuit Court for the Western District of New York, against the Castner Electrolytic Alkali Co. of the same city, alleging infringement of its many patents relative to its methods of making graphitized electrodes. It is well known to the world that in operation, under patents granted to Dr. Edward G. Acheson, the International Acheson Graphite Co. has developed, during the several years of its existence, a new art. The International Acheson Graphite Co., as well as its products, is known the world over, and it is far from the intention of that company to permit any infringement of the rights that have come to it through the various patents of wide scope and bearing which it holds.

WANTED

"Positions Wanted" advertisements not exceeding 50 words for subscribers to Practical Engineer will be inserted twice free of charge. "Help Wanted" and special advertisements 25 cents a line.

POSITION

With manufacturing company having opportunities to enter sales department by M. I. T. graduate, 27 years old. Have had experience in both shops and drawing room with two large concerns manufacturing engines, pumps, condensers, electrical machinery, air compressors, mining machinery, etc. Employed; references. Address Box 106, care of Practical Engineer. 7-2

POSITION

As fireman in place of advancement, by man 29 years old. Employed 14 years in present position. Charles Nelson, 48 Cheerver place, Brooklyn, N. Y. 7-2

POSITION

Asiatic agency wanted for American machinery by Japanese technical graduate, age 35, five years experience in leading railroad company as draftsman, also electrician and machinist. Address T. I., 312 South Carolina avenue, S. E., Washington, D. C. 6-2

POSITION

By young man, 24 years old, as oiler or helper. Have had 2 years' experience in power plants. Can furnish best of references. Address Box 103, care of Practical Engineer. 6-2

POSITION

By engineer, employed at present but desires change for reasons. Experienced in operating Corliss and automatic engines, A. C. machines and Fort Wayne street arc machines. Address Box 104, care of Practical Engineer. 6-2

POSITION

As stationary engineer in small power plant by a young man 27 years old. Has had some experience with dynamos. Owns tools for cutting and threading pipe. Best of references. Address Albert B. Howard, Bidwell, Ohio. 6-2

POSITION

By young man, 23 years old, in drafting room or machine shop. Am a student and a good worker, with good habits. Hold first class engineers license. Am about to graduate from A. S. C. in mechanical engineering course. Address John L. Kuhn, 7th street, N., Fargo, N. D. 6-2

POSITION

Engineer, 40, machinist by trade, college graduate, long experience, highly recommended, wants position as chief engineer in hotel, office building or factory. City or country. Results guaranteed. Address Box 102, care of Practical Engineer. 6-2

FOR SALE

60 steel storage tanks, 6,000 gallons' capacity. Good as new. Double riveted, extra well built. Suitable for storage of oils, waters or liquids of any kind. 100 steam pumps. Get our prices on engines, boilers and electrical machinery. All sizes and kinds. Chicago House Wrecking Co., 35th and Iron Sts., Chicago. 4 tf

ENGINEERS AND MECHANICS

To make big money selling Incomparable "ZIZ" Hand Soap. A 10-cent can will instantly remove more dirt and stains from the hands than four cakes of any soap made, and it will not injure the most delicate skin. Small sample free. Byram Mfg. Co., Box 3133, Boston, Mass. 4 tf

PATENTS

C. L. Parker, late Examiner, U. S. Patent Office, Attorney-at-Law and Solicitor of Patents. Patents secured promptly and with special regard to the legal protection of the invention. Handbook for inventors sent upon request. 186 McGill Building, Washington, D. C. 4 tf

PATENTS

Watson E. Coleman, Patent Attorney, Washington, D. C. Advice and books free. Highest references. Best services. 4tf

FOR SALE

One 16x10x10 Duplex, two stage, belt driven Laidlow-Dunn-Gordan Air Compressor, diagonal bearings with mechanically moved air inlet valves on low pressure cylinder. Capable of delivering 300 cubic feet of free air per minute. Used altogether about 16 months and is in good repair. Also one 100 H. P. Westinghouse Type S direct current motor, 500 volt, 685 revolutions, practically new. Send all correspondence to the Toledo-Flanner Boiler Co., Toledo, Ohio. 7 mc

POSITION

As first class electrician in plant of any capacity. Am experienced with all classes of direct and alternating current machinery, switchboards, wiring and transmission lines, also central and substations, etc. Formerly employed by largest electric light and power and industrial concerns in Pennsylvania. Would like to hear from interested parties. James E. Kilroy, Box 31, Lincoln place, Pennsylvania. 6-2

FREE

To one engineer in each town in charge of a steam plant, for 15 minutes of your time, we will give free of cost a first-class ludicator and reducing wheel, with velvet lined mahogany case. Give your home address and firm employed by. G. L. C. Co., corner 14th and Clark streets, Manitowoc, Wis. 7-1

AGENTS WANTED

Engineer salesman in each town to handle our Rear End Flue Blowers. Saves 25 per cent fuel and firemen's hardest work. Write U. S. Specialty Mfg. Co., Pittsburg, Pa. 7-1

POSITION

As head engineer and electrician. Understand the business from coal pile to lamps. Can also run Vilter refrigerating machine and do inside and outside wiring, pipe fitting, etc. At liberty July 10th. Address P. E. C., Box 366, Shawano, Wis. 7-2

POSITION

As mechanical draftsman by graduate of draftsman's courses with some experience. Location, east, with promising concern. Familiar with gas engines; employed in shop. Will start as detailer or tracer until ability is demonstrated. Age 21; strictly temperate. Let me send specimen drawings, etc., immediately. Address Box 105, Practical Engineer. 7-2